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QUARTERLY REPORT #4

FIELD DATA

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B. TERRESTRIAL V~~EGETATION~~

LE 7. Avian species list from
servations on or within 1.6 km
mile) of Utah Oil Shale Tracts, June
& August, 1975. X = bird observed.
=grassland, J=juniper, S=shadscale, R=riparian.

RD (ORDER / SPECIES)	DATE							
	June 1975				August 1975			
	VEGETATION TYPE				VEGETATION TYPE			
	G	J	S	R	G	J	S	R
seriformes								
Mallard	–	–	–	X	–	–	–	–
Gadwall	–	–	–	X	–	–	–	–
American Widgeon	–	–	–	X	–	–	–	–
Shoveler	–	–	–	X	–	–	–	–
Canada Goose	–	–	–	X	–	–	–	–
lconiformes								
Turkey Vulture	X	–	X	X	–	–	X	X
Marsh Hawk	X	–	X	–	X	–	–	X
Cooper's Hawk	–	–	–	–	X	–	–	X
Red-tailed Hawk	X	X	X	X	X	–	X	X
Golden Eagle	X	X	X	X	X	X	X	X
Prairie Falcon	X	X	X	X	X	X	X	–
Peregrine Falcon	–	–	–	–	–	–	–	X
American Kestrel	X	X	X	X	X	X	X	–
aradriiformes								
Spotted Sandpiper	–	–	–	LX	–	–	–	X
Killdeer	–	–	–	X	–	–	–	X
lumbiformes								
Mourning Dove	X	X	X	X	X	X	X	X
rigiformes								
Long-eared Owl	–	–	?	?	–	–	?	?
Great Horned Owl	–	–	?	?	–	X	?	X
primulgiformes								
✓ Poor-will	–	–	–	–	–	X	–	–
✓ Common Nighthawk	X	X	X	X	X	X	X	X
✓ Lesser Nighthawk	?	?	?	–	–	–	–	–
podiformes								
✓ White-throated Swift	X	–	–	X	X	X	–	X
Broad-tailed Hummingbird	X	–	–	X	–	–	–	?

(Page 2)

BIRD (ORDER/SPECIES)	June 1975 VEGETATION TYPE G	J	S	R	August 1975 VEGETATION TYPE G	J	S	R
Piciformes								
Downy Woodpecker	–	–	–	X	–	–	–	X
Yellow-bellied Sapsucker	–	–	–	X	–	–	–	–
Common Flicker	–	X	–	X	X	–	–	X
Passeriformes								
✓ Eastern Kingbird	X	–	–	X	–	–	–	–
✓ Western Kingbird	X	X	–	–	X	–	–	–
✓ Ash-throated Flycatcher	X	–	–	X	–	–	–	X
✓ Say's Phoebe	X	X	X	X	X	X	X	X
✓ Western Wood Pewee	–	X	–	X	–	X	–	–
✓ Dusky Flycatcher	X	–	–	X	–	–	–	–
✓ Gray Flycatcher	X	X	–	X	X	X	–	X
Horned Lark	–	X	X	–	–	–	X	–
✓ Cliff Swallow	X	–	X	X	–	–	X	X
✓ Tree Swallow	–	–	–	?	–	–	–	–
✓ Violet-green Swallow	X	X	X	X	X	–	–	X
✓ Rough-winged Swallow	–	–	–	X	X	–	X	X
Black-billed Magpie	X	X	X	X	–	–	–	X
Scrub Jay	–	X	–	–	–	–	–	–
Common Raven	X	X	X	X	–	–	–	–
Pinyon Jay	X	X	X	X	X	X	–	–
Plain Titmouse	X	X	–	–	–	–	–	–
Black-capped Chickadee	–	–	–	X	–	–	–	X
✓ Rock Wren	X	X	X	X	X	X	X	X
✓ Canyon Wren	X	–	–	–	–	–	–	–
✓ House Wren	–	–	–	?	–	–	–	–
Sage Thrasher	X	X	X	–	X	–	X	–
American Robin	–	–	–	X	X	–	–	X
✓ Mountain Bluebird	X	X	X	X	X	–	–	–
✓ Blue-gray Gnatcatcher	X	X	–	X	X	X	–	X
✓ Black-tailed Gnatcatcher	?	?	–	?	–	–	–	?
Cedar Waxwing	–	–	–	X	–	–	–	–
Loggerhead Shrike	X	–	X	–	X	–	X	–
Starling	–	–	X	X	–	–	X	–
✓ Red-eyed Vireo	–	–	–	?	–	–	–	–

age 3)

IRD (ORDER/SPECIES)	June 1975 VEGETATION TYPE G	J	S	R	August 1975 VEGETATION TYPE G	J	S	R
Passeriformes (CONTINUED)								
✓ Warbling Vireo	-	-	-	X	-	-	-	X
✓ Solitary Vireo	-	-	-	X	-	-	-	-
✓ Virginia's Warbler	X	-	-	X	-	-	-	-
✓ Orange-crowned Warbler	-	-	-	X	-	-	-	-
✓ Yellow Warbler	X	-	X	X	-	-	-	X
✓ Yellow-rumped Warbler	X	X	-	X	-	-	-	-
✓ Black-throated Gray Warbler	X	X	-	X	-	-	-	X
✓ MacGillivray's Warbler	X	-	-	X	-	-	-	-
✓ Common Yellowthroat	-	-	-	X	-	-	-	-
✓ Yellow-breasted Chat	-	-	-	X	-	-	-	X
✓ Wilson's Warbler	X	-	-	X	-	-	-	X
Brown-headed Cowbird	X	X	-	X	-	-	-	-
Red-winged Blackbird	X	-	-	X	-	-	-	-
Western Meadowlark	X	X	X	X	X	-	X	-
Scott's Oriole	-	-	-	-	X	X	-	-
Northern Oriole	-	-	-	X	-	-	-	-
Brewer's Blackbird	X	X	X	X	-	-	-	-
Western Tanager	X	X	-	X	-	-	-	X
House Finch	X	X	X	X	X	-	-	X
American Goldfinch	-	-	-	X	-	-	-	-
Lark Sparrow	X	X	X	X	X	-	X	X
White-crowned Sparrow	X	-	X	X	-	-	-	-
Chipping Sparrow	X	X	-	X	-	X	-	-
Brewer's Sparrow	X	X	X	X	X	X	X	X
Dark-eyed Junco	-	X	-	-	-	-	-	-
Black-throated Sparrow	X	X	X	X	X	X	X	X
Sage Sparrow	X	X	X	-	X	X	X	X
Song Sparrow	-	-	-	X	-	-	-	-
Rufous-sided Towhee	X	-	-	X	X	-	-	X
Black-headed Grosbeak	-	-	-	X	-	-	-	-
Blue Grosbeak	-	-	-	-	-	-	-	X
Lazuli Bunting	-	-	-	X	-	-	-	X

tah Oil Shale Tracts, June and August,
975. X = Mammal observed. G = greasewood,
= juniper, S = shadscale, R = riparian.

MAMMAL (ORDER / SPECIES)	June 1975 VEGETATION TYPE G	J	S	R	August 1975 VEGETATION TYPE G	J	S	R
Chiroptera								
Bat (unidentified species)	X	X	X	X	X	X	X	X
Carnivora								
Weasel (unidentified species)	-	-	-	-	X	X	-	-
Coyote	X	-	-	X	X	-	-	-
Mountain Lion	-	-	?	-	-	-	-	-
Rodentia								
Yellowbelly Marmot	-	-	-	-	?	-	-	-
Whitetail Antelope Squirrel	X	X	X	-	X	X	X	-
Golden-mantled Squirrel	X	X	-	-	X	X	X	X
Least Chipmunk	-	X	X	-	X	X	-	-
Colorado Chipmunk	X	X	-	-	X	X	-	-
Whitetail Prairie Dog	-	-	X	-	X	-	X	-
Apache Pocket Mouse	X	X	X	-	X	X	X	X
Ord Kangaroo Rat	X	-	X	X	X	-	X	X
Beaver	-	-	-	X	-	-	-	X
Western Harvest Mouse	X	-	-	-	-	-	-	-
Deer Mouse	X	X	X	X	X	X	X	X
Brush Mouse	-	-	-	-	-	X	-	-
Pinyon Mouse	-	X	-	-	-	X	-	-
Desert Woodrat	X	X	-	-	X	X	X	X
Bushytail Woodrat	-	-	-	-	-	-	X	X
Porcupine	-	-	-	X	-	-	-	-
agomorpha								
Desert Cottontail	X	X	X	X	X	X	X	X
rtiodactyla								
Mule Deer	X	X	X	X	X	X	X	X
Domestic Sheep	-	-	X	X	-	-	-	-
Domestic Cattle	-	-	X	X	-	-	X	X

bservations on or within 1.6 km (1mile) of
tah Oil Shale Tracts, June and August,
75. X = herptile observed. G=greasewood,
=juniper, S=shadscale, R=riparian.

	June 1975				August 1975			
	VEGETATION TYPE				VEGETATION TYPE			
MPHIBIAN (ORDER/SPECIES)	G	J	S	R	G	J	S	R
Salientia								
Great Basin Spadefoot	-	-	-	X	-	-	-	-
Woodhouse's Toad	-	-	-	-	-	-	-	X
Chorus Frog	-	-	-	?	-	-	-	-
Leopard Frog	-	-	-	-	-	-	-	X
REPTILE (ORDER/SPECIES)								
Squamata								
Western Fence Lizard	-	?	-	-	-	-	-	?
Eastern Fence Lizard	X	X	X	X	X	X	X	X
Sagebrush Lizard	X	X	X	X	X	X	X	X
Short-horned Lizard	-	-	X	-	-	-	X	-
Tree Lizard	-	X	-	X	X	X	-	X
Side-blotched Lizard	X	X	-	-	X	X	X	X
Western Whiptail	X	X	-	X	X	X	X	X
Racer	-	-	-	X	-	-	-	X
Striped Whipsnake	X	-	X	X	X	X	-	X
Gopher Snake	X	X	X	X	X	-	X	X
Western Terrestrial Garter Snake	-	-	-	X	-	-	-	X
Western Rattlesnake	X	X	-	-	X	X	X	-

TABLE 4. Bird numbers, estimated wet weight biomass and distance from transect line on sampling sites during June 1975 sampling period.
PG = primary greasewood,
SG = secondary greasewood,
OG = off-tract greasewood,
PJ = primary juniper,
SJ = secondary juniper,
OJ = off-tract juniper,
PS = primary shadscale,
SS = secondary shadscale,
OS = off-tract shadscale,
PR = primary riparian,
OR = off-tract riparian,
RG = riparian greasewood.

(Page 1) TABLE [See title opposite]

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (kg) OBSERVED	BIOMASS (kg) PER HA
PG	Mourning Dove	3	3										4	6			
	Eastern Kingbird					1							1	1			
	Gray Flycatcher			2									2	2			
	Black-billed Magpie	1								2	1		3	4			
	Pinyon Jay	37							3				6	40			
	Plain Titmouse		1	2									3	3			
	Rock Wren		2		2		1		1				6	6			
	Mountain Bluebird		1			1	3		2				5	7			
	Black-tailed Gnatcatcher	1		1									2	2			
	Loggerhead Shrike	1	1		1	1							4	4			
	Brewer's Blackbird			7									1	7			
	Western Meadowlark						1			1			2	2			
	Lark Sparrow	5											2	5			
	White-crowned Sparrow	1											1	1			
	Chipping Sparrow	9	1	2	2	2							10	16			
	Brewer's Sparrow	10	2	2		1							13	15			
	Black-throated Sparrow	5											4	5			
	Unidentified, Tyrannidae	1											1	1			
	Unidentified, Fringillidae	4	1	1	1								7	7			
	Unidentified, Passeriformes								1		1		2	2			
SG	Prairie Falcon	1											1	1			
	Mourning Dove					1	2						2	3			
	Say's Phoebe							1					1	1			
	Black-billed Magpie										1		1	1			
	Rock Wren	4		2		1	7	1	1				13	16			
	House Finch	3											1	3			
	Brewer's Sparrow	6	14	4	7	3	1						25	35			
	Black-throated Sparrow	4		1	2		3						6	10			
	Unidentified, Fringillidae	1	2	2			1						6	6			
	Unidentified, Passeriformes	1											1	1			

TAB 4 -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m)											NO. SAMPLES	DENSITY			
														NUMBER		BIOMASS (kg)	
		0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100		OBSERVED	PER HA	OBSERVED	PER HA
OG	Mourning Dove		1						2				2	3			
	White-throated Swift			2									1	2			
	Gray Flycatcher	1			1								2	2			
	Pinyon Jay	1											1	1			
	Canyon Wren	1											1	1			
	Red-winged Blackbird	4											3	4			
	Brewer's Blackbird	4	6	8									6	18			
	Western Meadowlark	3	1	2				1	1				7	8			
	Western Tanager		1										1	1			
	Lark Sparrow		2										1	2			
	Chipping Sparrow	5		2									4	7			
	Brewer's Sparrow	1											1	1			
	Black-throated Sparrow					3							1	3			
	Unidentified, Tyrannidae								1				1	1			
	Unidentified, Passeriformes										1		1	1			
PJ	American Kestrel							1					1	1			
	Mourning Dove	2			4		9	1	1				7	17			
	Common Nighthawk								1				1	1			
	Say's Phoebe		1										1	1			
	Gray Flycatcher	3	1	3	1	3							9	11			
	Black-billed Magpie				2								1	2			
	Scrub Jay			1									1	1			
	Pinyon Jay							3				3	2	6			
	Rock Wren	1			2		4	4					9	11			
	Mountain Bluebird		1		1		2	1					5	5			
	Black-throated Gray Warbler	1	5	3	2		3						11	14			
	Western Meadowlark										1		1	1			
	Brewer's Blackbird	2											2	2			
	Western Tanager	1											1	1			
	House Finch	2		1			3	3					9	9			
	Chipping Sparrow	1	1	2		1							4	5			
	Black-throated Sparrow	3	2			3							4	8			
	Unidentified, Tyrannidae	1						1					2	2			
	Unidentified, Fringillidae				1				1				2	2			
	Unidentified, Passeriformes	1	1		1				1				4	4			

Page 3) TAB -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	25-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	PER HA	BIOMASS (kg) OBSERVED	PER HA
SJ	American Kestrel					1							1	1			
	Mourning Dove	3							2				2	5			
	Western Wood Pewee			1									1	1			
	Gray Flycatcher	1											1	1			
	Pinyon Jay	5							5				4	10			
	Rock Wren		1										1	1			
	Sage Thrasher			1									1	1			
	Mountain Bluebird	1	1	2		2	1						5	7			
	Black-tailed Gnatcatcher				1								1	1			
	Black-throated Gray Warbler			2									1	2			
	Brown-headed Cowbird		2		2								2	4			
	House Finch	5	4	6		1	1						9	17			
	Chipping Sparrow	8			2		1						5	11			
	Brewer's Sparrow	2	2	2									3	6			
	Black-throated Sparrow		2		1								2	3			
	Sage Sparrow		2										1	2			
	Unidentified, Tyrannidae	1						1					2	2			
	Unidentified, Fringillidae		3		5								2	8			
	Unidentified, Passeriformes	1	1					1					3	3			
OJ	American Kestrel	1											1	1			
	Black-billed Magpie	3		2									5	5			
	Pinyon Jay	9											2	9			
	Rock Wren	3			2								5	5			
	Mountain Bluebird		2										1	2			
	Black-tailed Gnatcatcher		1										1	1			
	Black-throated Gray Warbler	3											1	3			
	Lark Sparrow		2		2								2	4			
	Chipping Sparrow	9											5	9			
	Unidentified, Tyrannidae					1							1	1			
	Unidentified, Fringillidae	1											1	1			

(Page 4) TABLE 4 -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	75-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	DENSITY NUMBER PER HA	DENSITY BIOMASS (kg) OBSERVED	DENSITY BIOMASS (kg) PER HA
PS	American Kestrel								1					1	1		
	Mourning Dove	4		1										2	5		
	Say's Phoebe	2					1							2	3		
	Violet-green Swallow	1												1	1		
	Rock Wren		1	1	1		2	1	4					10	10		
	Sage Thrasher	2						3	2					5	7		
	Mountain Bluebird	1												1	1		
	Western Meadowlark	2	5		3	1	1	4	2	2	1			17	21		
	Brewer's Blackbird				1									1	1		
	Lark Sparrow		1		1		2	1	1	1				6	7		
	Brewer's Sparrow	4	4		1			2						9	11		
	Black-throated Sparrow				4		2		2					4	8		
	Sage Sparrow.	7	2	2			2	1						14	14		
	Unidentified, Fringillidae	4		2	1		2		3					11	12		
	Unidentified, Passeriformes									1		1		2	2		
SS	Rock Wren							2						2	2		
	Loggerhead Shrike	1		1		4								4	6		
	Western Meadowlark	3		2	1	3	5	2						12	16		
	Lark Sparrow	2		1					1					3	4		
	Brewer's Sparrow	1	1		1									3	3		
	Sage Sparrow		1	2										2	3		
	Unidentified, Fringillidae						1	1						2	2		
	Unidentified, Passeriformes				2									1	2		
DS	Red-tailed Hawk								1					1	1		
	Mourning Dove	3												1	3		
	Say's Phoebe				1									1	1		
	Sage Thrasher	1												1	1		
	Mountain Bluebird				5									2	5		
	Western Meadowlark		1	1	1	1								4	4		
	Lark Sparrow	1												1	1		
	Brewer's Sparrow	9	4											10	13		
	Black-throated Sparrow	1			1									2	2		
	Sage Sparrow	7												5	7		
	Unidentified, Fringillidae		1											1	1		

(Page 5) T E 4 -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	75-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (kg) OBSERVED	BIOMASS (kg) PER HA
P.R.	Golden Eagle										2		2	2			
	Spotted Sandpiper			2						3			3	5			
	Mourning Dove				2			2	6				3	10			
	Downy Woodpecker			2									1	2			
	Common Flicker	1			1								2	2			
	Ash-throated Flycatcher	4											2	4			
	Western Wood Pewee						1						1	1			
	Gray Flycatcher						1						1	1			
	Black-billed Magpie		1					1					2	2			
	Black-capped Chickadee		1		1		1						3	3			
	Rock Wren						1						1	1			
	American Robin	1			1	1							3	3			
	Blue-gray Gnatcatcher	1	2										3	3			
	Black-tailed Gnatcatcher			1									1	1			
	Starling			1			3			1			5	5			
	Warbling Vireo						2						1	2			
	Solitary Vireo					2	2						2	4			
	Virginia's Warbler	1			1								2	2			
	Orange-crowned Warbler				1								1	1			
	Yellow Warbler	4	3	3	3		5	1					11	19			
	Common Yellowthroat	1											1	1			
	Yellow-breasted Chat					1							1	1			
	Brown-headed Cowbird	5		1	2		4	5	4				10	21			
	Western Meadowlark		1		2				2	1			5	6			
	Northern Oriole	1		2									2	3			
	Western Tanager			1				2					2	3			
	House Finch			2									1	2			
	Lark Sparrow	4											2	4			
	Chipping Sparrow	2	1										3	3			
	Rufous-sided Towhee	4	2			2		5					9	13			
	Black-headed Grosbeak				1								1	1			
	Lazuli Bunting		1		5			1					4	7			
	Unidentified, Strigidae									1			1	1			
	Unidentified, Tyrannidae	1					1						2	2			
	Unidentified, Sylviidae						1		1				2	2			
	Unidentified, Vireonidae	1											1	1			
	Unidentified, Parulidae				2				2				2	4			

(Page 6) TABLE 4 -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (kg) OBSERVED	BIOMASS PER HA
PR (Continued)	Unidentified, Fringillidae	2	2										2	4			
	Unidentified, Charadriiformes									1			1	1			
	Unidentified, Passeriformes			4		1	2						5	7			
OR	Canada Goose		2										1	2			
	Turkey Vulture				9								5	9			
	Spotted Sandpiper	1							2				2	3			
	Mourning Dove		3		2			9		1			5	15			
	Broad-tailed Hummingbird	1											1	1			
	Common Flicker							1					1	1			
	Western Wood Pewee		1	2	2								3	5			
	Cliff Swallow				230			160					9	390			
	Violet-green Swallow	1											1	1			
	Black-capped Chickadee	1						2					3	3			
	Rock Wren									1			1	1			
	American Robin	1			1		1		2				5	5			
	Cedar Waxwing								1				1	1			
	Starling	1	2				2						4	5			
	Virginia's Warbler	2	3	1	1		3						7	10			
	Orange-crowned Warbler					1							1	1			
	Yellow Warbler	7	3	10	6	7	2						23	35			
	Yellow-rumped Warbler		1										1	1			
	Yellow-breasted Chat	2	2	1			2		1				8	8			
	Wilson's Warbler	2		1		2							3	5			
	Brown-headed Cowbird		3	7	7		1			3			9	21			
	Northern Oriole					2		1					2	3			
	Western Tanager	2							2				2	4			
	House Finch	1	2	4	4	2	2	5					10	20			
	Rufous-sided Towhee	4	1	1			3			3			9	12			
	Black-headed Grosbeak				2	2	3						5	7			
	Lazuli Bunting	9		3	1	1	1						8	15			
	Unidentified, Anatidae				3								1	3			
	Unidentified, Trochilidae	1											1	1			
	Unidentified, Tyrannidae					1							1	1			
	Unidentified, Parulidae	1		1		1							3	3			
	Unidentified, Passeriformes						2				3		2	5			

(Page 7) TABLE -- Continued.

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (M) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER Observed	DENSITY NUMBER Per HA	DENSITY Clumps (k) Observed	DENSITY Clumps (k) Per HA
RG	Golden Eagle	1											1	1			
	Mourning Dove	6		3									3	9			
	Black-billed Magpie	4	5		5								6	14			
	Blue-gray Gnatcatcher	1	1										2	2			
	Black-tailed Gnatcatcher	4			2	1							7	7			
	Yellow-breasted Chat	1	1	2									3	4			
	Chipping Sparrow	2											2	2			
	Brewer's Sparrow	8	3										7	11			
	Black-throated Sparrow	2		1									3	3			
	Rufous-sided Towhee	8		4	1	1	1	1					14	16			
	Lazuli Bunting		1										1	1			
	Unidentified, Silviidae		1										1	1			
	Unidentified, Parulidae	1											1	1			
	Unidentified, Fringillidae		1										1	1			

(Page 1). TABLE 5. [See title opposite].

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (M) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (KG) OBSERVED	BIOMASS (KG) PER HA
PG	Mourning Dove	2	3	1			1	5					9	12			
	Say's Phoebe				1								1	1			
	Pinyon Jay	24						7	3				4	34			
	Rock Wren		1	2	1	1	4						8	9			
	Loggerhead Shrike	2	3										2	5			
	Black-throated Sparrow	1											1	1			
	Unidentified, Icteridae				1								1	1			
	Unidentified, Fringillidae	2		1			1						4	4			
	Unidentified, Passeriformes							1					1	1			
SG	Mourning Dove	3											3	3			
	Rock Wren	3		2	3	2	4		2	2			11	18			
	Lark Sparrow	1		3									3	4			
	Brewer's Sparrow	5											1	5			
	Black-throated Sparrow	3	2	5									4	10			
	Sage Sparrow	3	2	2			5						4	12			
	Fringillidae	32											2	32			
OG	Mourning Dove	25	14	19	13	2	2	1	2		2		29	80			
	Say's Phoebe	5	3	3	3			1					12	15			
	Gray Flycatcher			1									1	1			
	Violet-green Swallow	6											1	6			
	Rock Wren	2	1			1							3	4			
	Sage Thrasher	2		1									3	3			
	Loggerhead Shrike	1											1	1			
	Western Meadowlark	2		1	1								4	4			
	Lark Sparrow		1		4								2	5			
	Brewer's Sparrow	43	1		15								7	59			
	Sage Sparrow	9		16	10			2					6	37			
	Rufous-sided Towhee	1											1	1			
	Unidentified, Tyrannidae					1							1	1			
	Unidentified, Fringillidae	5											3	5			
	Unidentified, Passeriformes	2								1			2	3			

TABLE 5. Bird numbers, estimated wet weight biomass, and distance from transect line on sampling sites during August 1975 sampling period.

PG = primary greasewood,
SG = secondary greasewood,
OG = off-tract greasewood,
PJ = primary juniper,
SJ = secondary juniper,
OJ = off-tract juniper,
PS = primary shadscale,
SS = secondary shadscale,
OS = off-tract shadscale,
PR = primary riparian,
OR = off-tract riparian,
RG = riparian greasewood.

(Page 2) TAB[illegible]. (Continued).

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLED	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (KG) OBSERVED	BIOMASS PER HA
PJ	Mourning Dove	3	5				5						8	13			
	Western Wood Pewee					1							1	1			
	Pinyon Jay	15											2	15			
	Rock Wren		2	1	1								3	4			
	Blue-gray Gnatcatcher			2									1	2			
	Chipping Sparrow	3		10	3								3	16			
	Brewer's Sparrow	2		2					8				3	12			
	Black-throated Sparrow		2	2									2	4			
	Sage Sparrow	1											1	1			
	Unidentified, Fringillidae	5		5									3	10			
	Unidentified, Passeriformes							1					1	1			
SJ	Mourning Dove	2		1									2	3			
	Gray Flycatcher	1											1	1			
	Rock Wren	3		1	1		2						5	7			
	Chipping Sparrow	1	4	2	1	6							5	14			
	Unidentified, Tyrannidae			1									1	1			
	Unidentified, Fringillidae	1		1									2	2			
CJ	American Kestrel			1									1	1			
	Gray Flycatcher	1											1	1			
	Pinyon Jay				1					1			2	2			
	Rock Wren							1					1	1			
	Chipping Sparrow			2									1	2			
	Black-throated Sparrow		2										1	2			
	Unidentified, Fringillidae	1					1						2	2			
	Unidentified, Passeriformes	1	1		1								3	3			

(Page 3)

TA[illegible] 5. (Continued).

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	DENSITY NUMBER PER HA	DENSITY BIOMASS (kg) OBSERVED	DENSITY BIOMASS (kg) PER HA
FS	American Kestrel	1											1	1			
	Mourning Dove	1		1	1		1						4	4			
	Rough-winged Swallow	6											2	6			
	Rock Wren						2	2					2	4			
	Sage Thrasher						2						1	2			
	Loggerhead Shrike			3			4		2				6	9			
	Western Meadowlark	4	2				2						6	8			
	Lark Sparrow	1		1									2	2			
	Brewer's Sparrow			1									1	1			
	Sage Sparrow	5		2									4	7			
	Unidentified, Fringillidae	1											1	1			
SS	Mourning Dove	7											3	7			
	Rough-winged Swallow	10											3	10			
	Sage Thrasher	1											1	1			
	Loggerhead Shrike						2						1	2			
	Western Meadowlark	3					1						3	4			
	Lark Sparrow	4		1			1						6	6			
	Brewer's Sparrow	2											1	2			
	Black-throated Sparrow			1									1	1			
	Unidentified, Fringillidae						2						1	2			
OS	American Kestrel							1					1	1			
	Mourning Dove	3		1									3	4			
	Rock Wren							1					1	1			
	Brewer's Sparrow	1											1	1			
	Black-throated Sparrow	1		2	1	2	1						5	7			
	Sage Sparrow		1	1			1						3	3			

(Page 4) TABLE 5. (Continued).

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m)											NO. SAMPLES	DENSITY			
														NUMBER		BIOMASS (kg)	
		0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100		OBSERVED	PER HA	OBSERVED	PER HA
PR	Spotted Sandpiper	1											1	1			
	Mourning Dove	5											3	5			
	Common Flicker	1					1						2	2			
	Blue-gray Gnatcatcher	1	1	1									3	3			
	Yellow Warbler	6											2	6			
	Western Tanager	1											1	1			
	Rufous-sided Towhee			1									1	1			
	Unidentified, Tyrannidae	1											1	1			
	Unidentified, Hirundinidae	3											1	3			
	Unidentified, Vireonidae					1							1	1			
	Unidentified, Fringillidae	8					2						5	10			
OR	Red-tailed Hawk								1				1	1			
	Spotted Sandpiper			2	1		2						4	5			
	Mourning Dove	11		2					7				9	20			
	Downy Woodpecker							1					1	1			
	Common Flicker	2					1						3	3			
	Rough-winged Swallow	2	3										2	5			
	Blue-gray Gnatcatcher		1										1	1			
	Yellow Warbler	6	1										5	7			
	Black-throated Gray Warbler		2	1									2	3			
	Yellow-breasted Chat					2		1					2	3			
	House Finch		2										1	2			
	Lark Sparrow	4	7	5			6						5	22			
	Brewer's Sparrow				5								1	5			
	Rufous-sided Towhee	3		2	1		1						7	7			
	Unidentified, Hirundinidae	4											2	4			
	Unidentified, Fringillidae	2											1	2			
	Unidentified, Passeriformes									3			1	3			

(Page 5) TABLE 5. (Continued).

SAMPLING SITE	BIRD (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (kg) OBSERVED	BIOMASS (kg) PER HA
RG	Cooper's Hawk		1										1	1			
	Killdeer	4			1								3	5			
	Mourning Dove	4	1	2	3	2							9	12			
	Say's Phoebe	1											1	1			
	Violet-green Swallow	1	3										2	4			
	Black-billed Magpie					1							1	1			
	Rock Wren	2	1		4		3						9	10			
	American Robin							1					1	1			
	Blue-gray Gnatcatcher	5		1									3	6			
	Western Tanager	1											1	1			
	House Finch	4				1							2	5			
	Brewer's Sparrow	28	4	1									22	33			
	Black-throated Sparrow		1		2								2	3			
	Sage Sparrow			1									1	1			
	Rufous-sided Towhee	10	2	2	1								14	15			
	Lazuli Bunting			1									1	1			
	Unidentified, Trochilidae	1											1	1			
	Unidentified, Tyrannidae				1								1	1			
	Unidentified, Sylviidae	3											2	3			
	Unidentified, Fringillidae	4	3					2					8	9			
	Unidentified, Passeriformes	2											2	2			

(Page 1) TABLE 6. [See title opposite]

SAMPLING SITE	RODENT (SPECIES)	NUMBER CAPTURED					NUMBER CAPTURED FIRST TIME					DENSITY			
		DAY					DAY					NUMBER		BIOMASS (kg)	
		1	2	3	4	5	1	2	3	4	5	OBSERVED	PER HA	OBSERVED	PER HA
PG	Ord Kangaroo Rat	3	4	4	3	4	3	1	2	0	0	6			
	Apache Pocket Mouse	2	5	2	3	2	2	3	0	1	0	6			
	Deer Mouse	4	7	8	9	8	4	4	3	3	2	16			
SG	Apache Pocket Mouse	1	0	2	5	3	1	0	2	3	0	6			
	Deer Mouse	1	2	3	2	3	1	1	2	1	2	7			
	Western Harvest Mouse	1	1	0	1	0	1	1	0	0	0	2			
	Desert Woodrat	0	1	0	0	0	0	1	0	0	0	1			
OG (96 trap nights only)	Gilbert-mantled Squirrel	1	0	0	0	-	1	0	0	0	-	1			
	Ord Kangaroo Rat	1	0	0	0	-	1	0	0	0	-	1			
	Apache Pocket Mouse	0	0	1	0	-	0	0	1	0	-	1			
	Deer Mouse	2	4	4	7	-	2	3	0	3	-	8			
	Western Harvest Mouse	1	1	0	0	-	1	0	0	0	-	1			
PJ	Colorado Chipmunk	0	0	1	1	0	0	0	1	0	0	1			
	Apache Pocket Mouse	0	0	0	0	1	0	0	0	0	1	1			
	Deer Mouse	1	2	2	3	2	1	1	0	2	0	4			
	Pinyon Mouse	1	4	4	2	4	1	3	0	1	1	6			
	Desert Woodrat	0	0	1	1	1	0	0	1	0	1	2			
SJ (96 trap nights only)	Apache Pocket Mouse	1	2	2	3	-	1	2	0	2	-	5			
	Deer Mouse	1	3	4	6	-	1	2	2	2	-	7			
	Pinyon Mouse	0	2	1	1	-	0	2	0	0	-	2			
	Desert Woodrat	1(1)	0	0	0	-	1(1)	0	0	0	-	1			
	Unidentified, Peromyscus	0	1	0	0	-	0	1	0	0	-	1			
OJ	Whitetail Antelope Squirrel	0	0	1	0	0	0	0	1	0	0	1			
	Gilbert-mantled Squirrel	1	0	0	0	0	1	0	0	0	0	1			
	Colorado Chipmunk	1	2	2	3	1	1	2	0	1	0	4			
	Apache Pocket Mouse	0	1	0	0	0	0	1	0	0	0	1			
	Deer Mouse	4	5	6	6	8	4	2	1	2	2	11			
	Desert Woodrat	0	1	1	1	1	0	1	0	0	0	1			

TABLE 6. Number of rodents captured within rodent trapping transects on sampling sites during June 1975 sampling period (24 Sherman live traps for 5 days = 120 trap nights per sampling site, except where otherwise indicated ( ). PG = primary greasewood, SG = secondary greasewood, OG = off-tract greasewood, PJ = primary juniper, SJ = secondary juniper, OJ = off-tract juniper, PS = primary shadscale, SS = secondary shadscale, OS = off-tract shadscale, PR = primary riparian, OR = off-tract riparian, RG = riparian greasewood. ( ) = dead at capture.

(Page 2) TA 6 -- Continued.

SAMPLING SITE	RODENT (SPECIES)	NUMBER CAPTURED DAY 1	2	3	4	5	NUMBER CAPTU[illegible]ST TIME DAY 1	2	3	4	5	DENSITY NUMBER OBSERVED	PER Ha	BIOMASS (kg) OBSERVED	PER Ha
PS	Ord Kangaroo Rat	1	1	1(1)	0	0	1	0	0	0	0	1			
	Deer Mouse	3	4	3(1)	3	1	3	2	1	2	0	8			
SS	Deer Mouse	1	3(1)	3	4	3(1)	1	3(1)	2	3	0	9			
CS	Ord Kangaroo Rat	0	1	1	1	0	0	1	0	0	0	1			
	Apache Pocket Mouse	0	0	0	0	1	0	0	0	0	1	1			
	Deer Mouse	1	5	2	2	4	1	4	0	0	2	7			
PR	Deer Mouse	2	3	2	2	2	2	2	1	0	0	5			
SR	Deer Mouse	4	4	5	3	5	4	2	2	0	1	9			
	Desert Cottontail (Lagomorpha)	0	0	1	0	0	0	0	1	0	0	1			
RG	Ord Kangaroo Rat	1	1(1)	1	1	1	1	1(1)	0	0	1	3			
	Deer Mouse	6	8	6	6	7	6	3	1	1	2	13			

TABLE 7. Number of rodents captured within rodent trapping transects in sampling sites during August 1975 sampling period (24 Sherman live traps for 5 days = 120 trap nights per sampling site).

SG = secondary greasewood,
OG = off-tract greasewood,
SJ = secondary juniper,
OJ = off-tract juniper,
SS = secondary shadscale,
OS = off-tract shadscale,
OR = off-tract riparian,
RG = riparian greasewood.

(Page 1)	TA 7. [See title opposite]	NUMBER CAPTURED					NUMBER CAPTURE ST TIME					DENSITY			
		DAY					DA					NUMBER		BIOMASS (kg)	
SAMPLING SITE	RODENT (SPECIES)	1	2	3	4	5	1	2	3	4	5	OBSERVED	PER HA	OBSERVED	PER HA
SG	Apache Pocket Mouse	3	3	1	2	0	3	0	0	1	0	4			
	Deer Mouse	7	7	6	5	9	7	2	3	0	2	14			
OG	Whitetail Antelope Squirrel	0	0	0	1	2	0	0	0	1	2	3			
	Apache Pocket Mouse	0	1	2	2	0	0	1	2	1	0	4			
	Ord Kangaroo Rat	1	1	1	1	1	1	0	0	0	0	1			
	Deer Mouse	4	6	4	6	7	4	4	2	1	2	13			
	Desert Woodrat	0	0	0	1	0	0	0	0	1	0	1			
SJ	Apache Pocket Mouse	2	3	3	2	2	2	2	2	1	1	8			
	Deer Mouse	1	4	4	6	6	1	3	0	3	2	9			
	Pinyon Mouse	1	0	0	0	2	1	0	0	0	2	3			
	Desert Woodrat	0	0	0	0	1	0	0	0	0	1	1			
OJ	Colorado Chipmunk	2	1	2	2	3	2	1	0	1	0	4			
	Apache Pocket Mouse	1	0	0	0	0	1	0	0	0	0	1			
	Deer Mouse	2	6	6	6	3	2	3	2	0	1	8			
	Brush Mouse	0	1	1	1	1	0	1	0	0	0	1			
	Pinyon Mouse	1	2	2	1	1	1	1	0	1	0	3			
	Desert Woodrat	4	4	3	3	2	4	0	0	0	0	4			
SS	Apache Pocket Mouse	1	1	1	3	2	1	1	0	2	0	4			
	Ord Kangaroo Rat	0	1	0	0	0	0	1	0	0	0	1			
	Deer Mouse	2	3	5	6	6	2	1	2	2	2	9			
OS	Whitetail Antelope Squirrel	0	1	1	0	0	0	1	1	0	0	2			
	Apache Pocket Mouse	0	0	0	0	1	0	0	0	0	1	1			
	Ord Kangaroo Rat	2	2	2	2	3	2	0	0	0	1	3			
	Deer Mouse	6	5	7	7	6	6	1	3	1	0	11			
	Desert Woodrat	1	0	1	1	1	1	0	0	0	1	2			

(Page 2) TAB. 7. (Continued).

SAMPLING SITE	RODENT (SPECIES)	NUMBER CAPTURED					NUMBER CAPTUR[illegible]RST TIME					DENSITY			
		DAY					DAY					NUMBER		BIOMASS (KG)	
		1	2	3	4	5	1	2	3	4	5	OBSERVED	PER HA	OBSERVED	PER HA
OR	Apache Pocket Mouse	1	0	0	0	0	1	0	0	0	0	1			
	Deer Mouse	5	5	3	4	4	5	1	0	1	1	8			
	Bushytail Woodrat	1	0	0	0	0	1	0	0	0	0	1			
RG	Ord Kangaroo Rat	2	1	3	2	2	2	1	2	0	0	5			
	Deer Mouse	11	14	16	14	16	11	7	3	3	0	24			
	Bushytail Woodrat	0	1	1	0	0	0	1	0	0	0	1			

(Page 1) TABLE [See title opposite]

SAMPLING SITE	MAMMAL (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	NUMBER PER HA	BIOMASS (kg) OBSERVED	BIOMASS (kg) PER HA
PG	Desert Cottontail	1					1						2	2			
SG	Golden-mantled Squirrel						1						1	1			
	Least Chipmunk			1									1	1			
	Desert Cottontail	1		1		1			1				4	4			
OG	Desert Cottontail	4	2		3								9	9			
	Unidentified, Chiroptera	5		2									7	7			
PJ	Desert Cottontail		1						1				2	2			
	Unidentified, Chiroptera	1											1	1			
SJ	Colorado Chipmunk	1											1	1			
	Desert Woodrat				2								2	2			
	Desert Cottontail		1	2		1							4	4			
OJ	Desert Cottontail	6											6	6			
PS	Desert Cottontail	2	2	3			3		1				11	11			
SS	Desert Cottontail			1				1	1				3	3			
OS	Whitetail Antelope Squirrel				2								2	2			
	Desert Cottontail								2	2			4	4			

TABLE 8. Mammal numbers, estimated wet weight biomass and distance from transect line on sampling sites during August 1975 sampling period.

PG = primary greasewood,
SG = secondary greasewood,
OG = off-tract greasewood,
PJ = primary juniper,
SJ = secondary juniper,
OJ = off-tract juniper,
PS = primary shadscale,
SS = secondary shadscale,
OS = off-tract shadscale,
PR = primary riparian,
OR = off-tract riparian,
RG = riparian greasewood.

(Page 2) TABLE 8. (Continued)

SAMPLING SITE	MAMMAL (SPECIES)	DISTANCE (m) 0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100	NO. SAMPLES	DENSITY NUMBER OBSERVED	DENSITY NUMBER PER HA	DENSITY BIOMASS (kg) OBSERVED	DENSITY BIOMASS (kg) PER HA
PR	Beaver							1					1	1			
	Mule Deer			1						3			4	4			
	Domestic Cattle	16	3	4		3	4		3				33	33			
CR	Desert Cottontail	1		1		1							3	3			
	Mule Deer						1	1					2	2			
	Unidentified, Chiroptera	5		1									6	6			
RG	Golden-mantled Squirrel				1								1	1			
	Desert Cottontail			1		1		1					3	3			
	Unidentified, Chiroptera	2											2	2			

(Page 1) TABLE 9. [See title opposite]

SAMPLING SITE	MAMMAL (SPECIES)	DISTANCE (m)											NO. SAMPLED	DENSITY			
														NUMBER		BIOMASS (kg)	
		0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100		OBSERVED	PER HA	OBSERVED	PER HA
PG	Whitetail Antelope Squirrel	1							1				2	2			
	Golden-mantled Squirrel									1			1	1			
	Desert Cottontail								1	1			2	2			
SG	Whitetail Antelope Squirrel			4	13								17	17			
	Desert Cottontail		1			1							2	2			
OG	Whitetail Antelope Squirrel				1								1	1			
	Golden-mantled Squirrel	1											1	1			
	Desert Cottontail			1			1						2	2			
	Unidentified, Chiroptera								1				1	1			
PJ	Desert Cottontail Rabbit		2	1									3	3			
SJ	NONE												0	0			
OJ	Golden-mantled Squirrel	1							1	3			5	5			
	Colorado Chipmunk					1							1	1			
	Desert Cottontail	1											1	1			
	Mule Deer											1	1	1			
PS	Whitetail Antelope Squirrel			1									1	1			
	Desert Cottontail	1	1	1	1			8	1				13	13			
SS	Desert Cottontail								1				1	1			
OS	Desert Cottontail			1		1							2	2			

TABLE 9. Mammal numbers, estimated wet weight biomass, and distance from transect line on sampling sites during June 1975 sampling period.

PG = primary greasewood,
SG = secondary greasewood,
OG = off-tract greasewood,
PJ = primary juniper,
SJ = secondary juniper,
OJ = off-tract juniper,
PS = primary shadscale,
SS = secondary shadscale,
OS = off-tract shadscale,
PR = primary riparian,
OR = off-tract riparian,
RG = riparian greasewood.

(Page 2) TABLE 9 -- Continued.

SAMPLING SITE	MAMMAL (SPECIES)	DISTANCE (M)											NO. SAMPLES	DENSITY			
														NUMBER		BIOMASS (kg)	
		0-5	6-10	11-15	16-20	21-25	26-30	31-40	41-50	51-75	76-100	>100		OBSERVED	PER HA	OBSERVED	PER HA
PR	Beaver						1						1	1			
	Porcupine								1				1	1			
	Desert Cottontail	2											2	2			
	Mule Deer		1										1	1			
	Unidentified, Chiroptera						4						4	4			
OR	Desert Cottontail		1					2					3	3			
RG	Golden-mantled Squirrel						1						1	1			
	Colorado Chipmunk					1							1	1			
	Desert Cottontail	3	3							2	1		9	9			

TABLE 10. Herptile numbers, estimated wet weight biomass, and distance from transect line on sampling sites during June 1975 sampling period. PG = primary greasewood, SG = secondary greasewood, OG = off-tract greasewood, PJ = primary juniper, SJ = secondary juniper, OJ = off-tract juniper, PS = primary shadscale, SS = secondary shadscale, OS = off-tract shadscale, PR = primary riparian, OR = off-tract riparian, RG = riparian greasewood.

(Page 1)	TABLE 10. [Continued opposite]	DISTANCE (m)								DENSITY			
										NUMBER		BIOMASS (kg)	
SAMPLING SITE	HERPTILE (SPECIES)	0	1	2	3	4	5	>5	NO. SAMPLES	OBSERVED	PER HA	OBSERVED	PER HA
PG	Eastern Fence Lizard			1					1	1			
	Sagebrush Lizard		4						4	4			
	Western Whiptail		2		1				3	3			
	Unidentified, lizard		1	1					2	2			
SG	Sagebrush Lizard	2	7	2					12	12			
	Western Whiptail		4						4	4			
OG	Sagebrush Lizard			1					1	1			
	Western Whiptail		1		1	1			3	3			
	Western Rattlesnake		1		1				2	2			
	Unidentified, lizard			1					1	1			
PJ	Eastern Fence Lizard	1	8						9	9			
	Sagebrush Lizard	2	15	2					19	19			
	Tree Lizard		1						1	1			
	Side-blotched Lizard		1						1	1			
	Western Whiptail		1	2					3	3			
	Unidentified, lizard		2						2	2			
SJ	Eastern Fence Lizard			1					1	1			
	Sagebrush Lizard		5		2				7	7			
	Side-blotched Lizard			2					2	2			
	Western Whiptail				1		1		2	2			
	Unidentified, lizard			1			1		2	2			
OJ	Eastern Fence Lizard				1				1	1			
	Sagebrush Lizard		2						2	2			
	Side-blotched Lizard		1						1	1			
	Western Whiptail		3						3	3			
	Unidentified, lizard			1					1	1			

(Page 2) TABLE 10 -- Continued.

Sampling Site	Herptile (Species)	Distance (m) 0	1	2	3	4	5	>5	No. Samples	Density Number Observed	Number Per Ha	Biomass (kg) Observed	Biomass (kg) Per Ha
PS (Stratum only)	Sagebrush Lizard Short-horned Lizard Unidentified, lizard		12 4 1						12 4 1	12 4 1			
SC (Stratum only)	Sagebrush Lizard Short-horned Lizard		1 2						1 2	1 2			
GC (Stratum only)	Sagebrush Lizard Unidentified, lizard		4	2	2	 1			8 1	8 1			
PR	Eastern Fence Lizard Racer Gopher Snake		 1 1	 1	1				1 2 1	1 2 1			
OR	Eastern Fence Lizard Sagebrush Lizard Western Whiptail Racer	2 1 1	1 1	1 1 1					4 1 3 1	4 1 3 1			
RG (Stratum only)	Sagebrush Lizard Unidentified, lizard		7 1	2	2 1	 1			11 3	11 3			

(Page 1)

SAMPLING SITE	TABLE 11. [See title opposite] HERPTILE (SPECIES)	DISTANCE (m)							NO. SAMPLED	DENSITY			
										NUMBER		BIOMASS (kg)	
		0	1	2	3	4	5	>5		OBSERVED	PER HA	OBSERVED	PER HA
PG	Sagebrush Lizard		3						3	3			
SG	Eastern Fence Lizard		1						1	1			
	Sagebrush Lizard		16	2					18	18			
	Side-blotched Lizard		2						2	2			
	Western Whiptail		1	3					4	4			
	Striped Whipsnake		2						2	2			
OG	Side-blotched Lizard		1						1	1			
	Western Whiptail		1						1	1			
PJ	Eastern Fence Lizard		1	3					4	4			
	Sagebrush Lizard		16	5					21	21			
	Side-blotched Lizard		9						9	9			
SJ	Sagebrush Lizard		12						12	12			
	Side-blotched Lizard		3						3	3			
	Western Whiptail		1	1					2	2			
OJ	Sagebrush Lizard		6						6	6			
	Side-blotched Lizard		1						1	1			
	Western Whiptail		5						5	5			
	Unidentified, lizard		1						1	1			
PS	Eastern Fence Lizard					1			1	1			
	Sagebrush Lizard		9	4	2				15	15			
	Short-horned Lizard		1	1					2	2			
	Side-blotched Lizard		1	1	1				3	3			
	Unidentified, lizard		1	3					4	4			

TABLE 11. Herptile numbers, estimated wet weight biomass, and distance from transect line on sampling sites during August 1975 sampling period. PG = primary greasewood, SG = secondary greasewood, OG = off-tract greasewood, PJ = primary juniper, SJ = secondary juniper, OJ = off-tract juniper, PS = primary shadscale, SS = secondary shadscale, OS = off-tract shadscale, PR = primary riparian, OR = off-tract riparian, RG = riparian greasewood.

(Page 2) TABLE 1. (Continued).

SAMPLING SITE	REPTILE (SPECIES)	DISTANCE (m) 0	1	2	3	4	5	>5	NO. SAMPLED	DENSITY NUMBER OBSERVED	PER HA	BIOMASS (kg) OBSERVED	PER HA
SS	Sagebrush Lizard		4	1					5	5			
	Short-horned Lizard		1						1	1			
	Side-blotched Lizard		1	1					2	2			
	Unidentified, lizard		2						2	2			
OS	Sagebrush Lizard		14						14	14			
	Unidentified, lizard		1						1	1			
PR	Leopard Frog		1						1	1			
	Sagebrush Lizard		1						1	1			
	Side-blotched Lizard		2						2	2			
	Western Whiptail		1						1	1			
	Racer		1						1	1			
	Striped Whipsnake		1						1	1			
	Gopher Snake		1						1	1			
	Western Terrestrial Garter Snake			1	1				2	2			
	Unidentified, lizard			1	1				2	2			
OR	Eastern Fence Lizard			1	2				3	3			
	Sagebrush Lizard		4						4	4			
	Western Whiptail		2	1					3	3			
RG	Eastern Fence Lizard		1						1	1			
	Sagebrush Lizard		3	1					4	4			

C. MICROBIOLOGY

MATERIALS AND METHODS

Soils and Sampling Stations.

Four sampling stations were established near soil survey pits No. 39, 50, 55, and 58, and located with marked stakes. Station 39 is located near pit #39, 1.5 m E. of the old road. The dominant vegetation at this station is *Atriplex tridentata* and *Artemisia nova*. Station 50 J is located some distance from pit #50 in a juniper area. The vegetation at this station is dominated by *Artemisia nova* and *Juniperus monosperma*. Sampling station 55 R is located 5 meters off the White River bank, dominated by a mixed riparian vegetation. Sampling station 58 is dominated by *Artemisia nova* and *Sarcobatus vermiculatus*.

The chemical and physical characteristics of soils of survey pits 39, 55, and 58 are shown in Table 1 (from report, this project, Section V-2). The station 50 J is located distant from a soil survey pit and the soil of this station was analyzed in detail (Table 2).

Sample designations are as follows:

39 - 1	Surface - 3 cm	55 R - 1	Surface - 3 cm
39 - 2	5-20 cm	55 R - 2	5-20 cm
39 - 3	40-50 cm	55 R - 3	40-50 cm

TABLE 1

Soil Analysis

Collector's Number	Depth cm	Particle Size Distribution (%)			% >2mm	Textural Class	pH Saturated Paste	Organic Carbon %
		Silt	Clay Hydrometer	Sand				
#39	0-4	9	8	83	4	LS	8.1	0.5
	4-17	11	11	78	7	SL	8.2	0.5
	17-35	8	10	82	25	LS	8.5	0.5
#55	0-5	31	9	60	4	SL	7.7	0.7
	5-15	35	10	55	3	SL	7.8	0.4
	15-40	39	10	51	5	L	7.8	0.3
	40-120	38	10	52	6	SL	8.0	0.4
	120-160	34	12	54	9	SL	7.7	0.3
#58	0-10	29	10	61	2	SL	9.9	0.5
	10-34	14	10	76	6	SL	10.4	0.3
	34-72	10	6	84	38	LS	8.0	0.3
	72-127	14	9	77	61	SL	8.0	0.2

TABLE 1 (cont.)

Soil Analysis

Electrical Conductivity EC x 10^3 Millimhos per cm 25 C	$CaCO_3$ %	Moisture Tensions		Extractable Cations ppm NH_4OAc me/100 g			Avail P ppm	Percent Moisture at Saturation
		1/3 Atmos. %	15 Atmos. %	Mg	Na	k		
0.6	3.0	8.1	4.6	1.0	0.3	0.4	16	29
0.5	3.7	9.3	5.8	1.3	0.5	0.2	3.2	32
0.3	6.8	10.4	6.3	1.0	0.5	<0.1	1.0	38
0.8	2.9	10.0	4.8	2.7	0.3	1.4	24	33
0.6	3.1	11.0	5.5	2.5	0.3	0.5	2.6	28
0.4	4.9	12.4	5.9	2.7	0.4	0.2	1.8	33
0.8	4.9	13.5	6.3	3.4	1.1	0.2	1.9	35
16.0	6.0	14.6	6.4	4.4	6.7	0.3	9.2	34
5.0	6.2	11.3	5.8	1.2	6.9	1.3	8.9	41
12.0	5.7	8.7	6.6	0.4	10.3	0.3	10.9	30
15.0	5.3	7.6	6.0	0.9	3.1	0.1	2.1	26
3.5	14.6	10.8	5.8	1.5	1.4	0.1	1.8	28

TABLE 2

Chemical Analysis of Stations 50 J-I-1 and 50 J-I-2

	50 J-I-1	50 J-I-2
pH	8.1	8.1
Salinity (ECe): mmhos/cm	0.4	0.6
Phosphorous: ppm	4.0	1.6
Exchangeable Sodium: Me/100 g	0.39	0.48
Exchangeable Magnesium: Me/100 g	0.02	0.04
Exchangeable Potassium: Me/100 g	0.37	0.14
Extractable Sodium: Me/100 g	0.42	0.58
Extractable Potassium: Me/100 g	0.37	0.14
Extractable Magnesium: Me/100 g	0.03	0.06
Lime ($CaCO_3$ equiv): %	2.5	17.9
Nitrogen (Nitrate): ppm	1.2	1.4
Nitrogen (Total): %	0.10	0.15
Organic Carbon: %	0.94	1.33
Water Soluble Sodium: Me/100 g	0.03	0.10
Water Soluble Magnesium: Me/100 g	0.01	0.02
Water Soluble Potassium: Me/100 g	<0.01	<0.01
Moisture (1/3 Atm): %	18.3	22.9
Moisture (15 Atm): %	6.8	10.7
Moisture (Saturation): %	34.0	45.0
Sand: %	53.0	48.0
Silt: %	33.0	35.0
Clay: %	14.0	17.0
Classification	SL	L

50 J - I - 1	Surface 3 cm, Interspace
50 J - I - 2	5-20 cm, Interspace
50 J - L	Surface litter, beneath *J. monosperma* canopy
50 J - C - 1	2-4 cm, beneath canopy
50 J - C - 2	4-15 cm, beneath canopy
58 - I - 1	Surface 3 cm, Interspace
58 - I - 2	5-20 cm, Interspace
58 - I - 3	40-50 cm, Interspace
58 - C - 1	Surface 3 cm, beneath *A. nova* canopy
58 - C - 2	5-20 cm, beneath canopy
58 - C - 3	40-50 cm, beneath canopy

Each sample is ground upon the receipt in laboratory or particles larger than 3 mm diameter are removed. The sample is then returned to storage at 4° C until examined.

Determination of Microbial Numbers.

One gram of each sample was placed in a 250 ml screw-cap Erlenmeyer flask containing 99 ml sterile distilled water to give a 1:100 dilution. After vigorous shaking, further dilution of 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6} were made in screw-cap tubes containing 9 ml of sterile distilled water. Five plates were made for each dilution. Plates with 10^{-2}, 10^{-3} and 10^{-4} dilutions were poured with Martin's Medium for the enumeration of fungi. Plates with 10^{-4}, 10^{-5} and 10^{-6} dilutions were poured with soil extract agar for the enumeration of bacteria and streptomycetes.

After thorough mixing, the agar was allowed to harden, and the plates were incubated at 22° C.

The fungal plates were counted after 5 days, the bacterial colonies on the soil extract agar plates were counted after 5 days and the streptomycetes on the same plates between 7 and 14 days.

For microaerophilic plate counts, soil dilutions of 10^{-3} and 10^{-4} will be plated with Brewer's Anaerobic Agar (Difco). The solidified plates were placed upright in desiccator jars of BBL anaerobic system. The desiccators contained a small amount of CO_2 and H_2. After 7 days the plates were removed and counted.

All microbial counts are reported on an oven-dry soil weight basis.

Media: For streptomycetes and total aerobic bacteria soil extract agar with glucose was used (based on Fred and Waksman, 1928):

Agar	15.0 g
K_2HPO_4	0.5 g
Soil extract	100 ml
Tap water	800 ml

One gram of glucose in 100 ml of distilled water was autoclaved separately and added to the sterile medium before use. The pH was adjusted to 6.8 - 7.2 before the medium was autoclaved.

Soil extract: autoclave 1000 g of garden soil with 1000 ml of tap water for 60 minutes. Add 10 g of $CaCO_3$. Stir and filter on a Buchner funnel with double Whatman #5 filter paper. The filtrate may need to be refiltered to obtain a clear solution.

The filtrate was sterilized in 100 ml quantities and stored in refrigerator.

Martin's Medium for fungi (Allen, 1957):

Peptone	5.0 g
KH_2PO_4	1.0 g
$MgSO_4 . 7H_2O$	0.5 g
Rose Bengal	0.033 g
Agar	20.0 g
Tap Water	900 ml
Glucose	10 g in 100 ml distilled water autoclaved

Glucose was dissolved in 100 ml distilled water and sterilized separately, then added to medium after both were sterilized. The medium was heated to dissolve agar and then sterilized for 15 min. at 15 ps. The pH was adjusted to 6.8 - 7.2 before the medium was autoclaved.

Streptomycin was weighed out under asceptic conditions and 4 g dissolved in 100 ml of sterile distilled water, poured into a 0.20 μ millipore filter, filtered and poured into a presterilized 250 ml screw-cap Erlenmyer flask. This was stored in a refrigerator and 0.01 ml added to each plate for each 10 ml of agar before pouring plates. It may be added to cooled sterile medium immediately before using. Stable for 6 - 10 weeks.

Soil Respiration. (Elkan and Moore, 1962)

Ten grams of soil sample were placed in a 125 ml screw-capped Erlenmeyer flask with center well. One ml of 0.04 N $Ba(OH)_2$ solution was added to the center well. The blank contained no soil but one ml of distilled water. The flasks were tightly capped and incubated in a 30° C shaking water bath for 90 minutes. Titration was carried out with 0.02 N HCl until a clear solution was obtained. One ml of the untreated $Ba(OH)_2$ solution was also titrated to determine the normality of the standing solution. The 0.02 N HCl was made fresh for each day.

The ml of NCl to titrate the $Ba(OH)_2$ was multiplied by 0.02 N to obtain the starting normality. The final normality (ml to titrate the sample x 0.02) was subtracted from the original, then the blank was subtracted from the result. This yields the total milliequivalents of CO_2.

Before each incubation, the negative water potentials of each soil sample were measured as described below. The water potentials were again measured at the end of the incubation time for each soil sample. The average negative bar reading between the beginning and ending was the approximate negative bar pressure of the sample during the reaction time.

Dehydrogenase Activity. (Casida, Klein and Santoro, 1964)

Each soil sample was weighed into three sterile screw-cap tubes, 6 g per tube. To two of the tubes were added 2.5 ml sterile distilled water and 1.0 ml 3% aqueous solution of 2, 3, 5-triphenyltetrazolium chloride. To the third tube (control) 3.5 ml sterile distilled water was added. The tubes were mixed thoroughly with a Vortex mixer and then incubated in a 30 C incubator for 24 hours.

Extraction of the triphenyltetrazolium formazan produced was carried out with methanol. The samples were removed from the tubes by shaking with methanol onto a 125 ml Buchner funnel fitted with Whatman #5 filter paper. The soil was washed with methanol until no more color could be extracted. During this procedure, it was necessary to keep the sample wet at all times until extraction was complete to avoid air drawn through the soil.

The filtrate was then poured into a 100 ml vol. flask and made up to volume with methanol. After mixing approximately 20 ml was poured into tubes for the determination of absorbance. The absorbance was read on a B & L

Spectronic 20 at 485 nm. In some cases, due to suspended soil particles which were not removed by filtration, it was necessary to centrifuge filtrate at 14,000 rpm for 40 minutes before reading the absorbance.

The readings were compared to a standard formazan curve in order to determine the amount of formazan in the diluted filtrate. The results are reported as mg formazan in 100 ml of filtrate.

For a standard formazan curve, 1.5 mg of triphenyltetrazolium formazan was dissolved in 50 ml methanol to obtain 0.03 mg/ml formazan. Serial 1:2 dilutions of this solution were made to develop a standard formazan curve.

Proteolytic Activity. (Hoffmann and Teicher, 1957)

For the assay 10 g of soil sample were placed in each of two 100 ml screw-cap volumetric flasks. 500 mg of calcium carbonate was added to each flask and mixed in; 1.5 ml of toluene was added drop by drop so that most of the soil was dampened. After standing for 15 minutes, 20 ml of a freshly made 2% gelatin solution was added to one flask, and 20 ml of distilled water to the other flask. After thorough mixing, the flasks were placed on a rotating apparatus in a 37° C incubator.

After 20 hours incubation, the flasks were removed from the incubator and filled to the mark with 37° C distilled water (the toluene was above the mark). After shaking the contents of each flask were gravity filtered through a double filter paper consisting of Whatman #5 on the outside and Whatman #2 on the inside.

To assay for the amount of hydrolyzed gelatin, 5 ml of each filtrate was placed in a centrifuge tube. To each was added 5 ml of a cupric phosphate suspension. The mixture of filtrate and cupric phosphate suspension was

allowed to stand for 5 minutes with occasional shaking, centrifuged at 7000 rpm for 5 minutes and supernatant decanted into photometer tubes. The absorbance at 660 nm was read on a B & L Spectronic 20.

The standard solution for this assay was a 2% solution containing the appropriate amino acids by weight that make up gelatin. Since the 2% gelatin used in the assay is diluted 1:5 before the absorbance is read, portions of the above solution were also diluted 1:5. This dilution was then considered to represent 100% hydrolysis of gelatin.

Cupric phosphate suspension:

cupric chloride	28 g/l
sodium phosphate	68.5 g/l
sodium borate	10.1 g/l, pH 9.1 - 9.2
sodium chloride	6 g/100 ml

To 40 ml of sodium phosphate solution add 20 ml of cupric chloride solution with stirring. Centrifuge the mixture at 7000 rpm for 5 min. Discard the supernatant and wash the precipitate twice by resuspending in 60 ml of sodium borate buffer and centrifuge after each washing. Resuspend washed precipitate in 100 ml of borate buffer and add 6 g of NaCl. Stir until dissolved and store in glass-stoppered bottle. Discard after 10 days.

ATP Concentration.

There exists a linear relationship between the amount of ATP added to the firefly (*Photinus pyralis*) luciferin-luciferase system and the duration of light out-put. The following is a summary of the mechanism of light emission.

$$LH_2 + ATP + E \xrightleftharpoons{Mg^{++}} E \,.\, LH_2 \,.\, AMP + PP$$

$$E \,.\, LH_2 \;\; AMP + O_2 \xrightarrow[pH]{neutral} E + product + CO_2 + AMP + Light$$

LH_2 = luciferin
E = luciferase

This relationship, therefore, is the basis for the assay of microgram quantities of ATP by measuring the light intensity of the luminescence.

To prepare the luciferin-luciferase suspension, a vial of firefly lantern extract (Sigma FLE-50 or 250) was rehydrated with deionized-distilled water. The vial was left to stand at room temperature for two hours and then stored at 4° C. Before use, the suspension was centrifuged at 10,000 g for 10 minutes to remove insoluble debris.

A standard stock solution was prepared initially by dissolving 10 mg of crystalline disodium ATP in 1000 ml Tris buffer (0.25 M). The solution was capped and stored at -4° C and working standards were prepared by thawing and diluting stock solution with Tris buffer to the desired concentration. A standard curve of concentration vs. midrange of count sequence was plotted on log paper and unknowns determined by such a curve. It is necessary to count the standards with each sample determination.

A liquid scintillation spectrometer, Packard Tri-carb Model 527, was used to determine light intensity. The settings included, 1) one channel only, 2) amplification set at 10%, 3) discriminators set at 50-1000, 4) repeat mode used for 20 sequential counts and 5) spectrometer used out-of-coincidence.

Two grams of soil were placed in a 250 ml boiling flask and 25 ml of 1:1 boiling solution of Tris buffer and 95% ethenol were added. The flask was placed on a high vacuum rotating evaporator so that it was partially submerged

in a 55° C water bath. After 5 minutes, the contents of the flask were brought up to a 25 ml volume with ice cold Tris buffer. Then the soil extract was centrifuged for 10 minutes at 10,000 g to remove the soil particles. Aliquots of the extract were dispensed into test tubes, capped and placed in an ice bath for immediate assay.

For the light intensity, exactly 1.8 ml of standard or soil extract ATP solution were pipeted into a glass liquid scintillation counting vial. At zero time, 0.2 ml of reconstituted enzyme extract were added and shaken. Then the vial was placed on the elevator of a liquid scintillation counter and lowered into the counting chamber. The first count was begun 15 seconds after the enzyme addition for 6 seconds with a 2 second interval between counts for print-out.

The analysis was conducted in semi-darkness to avoid chemoilluminescence and the scintillation vials were stored in the dark when not in use.

A blank was made by adding 0.2 ml of enzyme to 1.8 ml Tris buffer. In addition, a soil extract blank was made by counting 1.8 ml of extract alone. The average of sequential counts was subtracted from the luminated samples.

Nitrification.

Nitrification potential *in vitro* was measured by a perfusion method as follows: To a 70 - 80 g soil sample was added VAMA (krilium), a soil conditioner, 0.2% per weight of dry soil. Enough distilled water was added to obtain a smooth paste which was sieved to obtain 2-5 mm crum-like particles. The soil was then air dried for two days.

After drying, 30 g of stabilized soil were placed in a perfusion apparatus containing 250 ml of water. This was done in duplicate for each sample in

order to have a control and experimental sample. The samples were perfused for 24 hours, the water was discarded and 250 ml of 0.01 M $(NH_4)_2SO_4$ was added. The samples were then perfused for 20 days and a 5 ml aliquot of perfusate was collected every 2 days for analysis. The perfusates were analyzed colorimetrically for NH_4^+, NO_2^- and NO_3^-.

The tests were run at 20° C in the dark and the soil was under conditions of optimal aeration and water saturation, but not water-logging.

Organic Carbon.

Reagents:

1. Potassium dichromate, 0.167 M. Weigh accurately 49.03g $K_2Cr_2O_7$ into a 1-liter volumetric flask. Dissolve in distilled water and make to volume.
2. Sulfuric acid, reagent, concentrated.
3. For soils containing chlorides, use acid containing 25g Ag_2SO_4 per liter.
4. Organic matter standards (soils).
   Univ. of Missouri standards 2.3 and 4.8% O.M. (1.34 and 2.68% O.C., resp.). Other similar standards prepared locally, -60 mesh, and analyzed with reference to the Univ. of Missouri standards.

Procedure:

Grind soil sample as necessary to pass -60 mesh screen. Avoid iron tools.

Test soil or saturation extract for presence of chlorides. If a visible precipitate is formed with $AgNO_3$, use reagent 3 in the procedure below.

Weigh 0.50g samples of soils and standards into dry 125-ml Erlenmeyer flasks.

Pipet 5.00 ml of reagent 1 into the flask and swirl gently to mix.

Add 10.0 ml of reagent 2 or 3 as rapidly as possible.

Swirl and place on a cardboard or asbestos pad. Swirl again after about 1 minute. Note time.

After 20 ± 2 minutes, add 50.0 ml distilled water, mix and filter. (Samples can be left overnight after water is added.)

Read color intensity at 610 nm (blue phototube in Spectronic 20) with a reagent blank set at zero absorbance.

Plot absorbance vs. organic carbon or organic matter on 10 x 10 linear paper.

Total Nitrogen.

It is basically the Kjeldahl Method but includes some modification made by Utah State University Soils Laboratory (1961) and other workers (Bremner).

Reagents:

1. Concentrated sulfuric acid, reagent grade, specific gravity 1.84.

2. Concentrated sodium hydroxide solution 40-45% NaOH by weight.

3. Digestion mixture. Prepare by mixing thoroughly finely ground reagents in the following proportions. 500 g sodium sulfate, anhydrous powder, 50 g copper sulfate, anhydrous powder, and 5 g of powdered selenium metal.

4. Indicator solution. See page 16 for instruction on making indicator. This indicator may be added directly to the stock solution of boric acid to avoid the necessity of individual sample additions during the analysis. The amount to be used depends upon the color desired by the analyst. Usually 75 to 100 ml of this mixed indicator is used per 18 liters of 2% boric acid solution.

5. Boric acid solution 2%. Dissolve 360 grams of reagent grade boric acid in 18 liters of distilled water.

6. Standard Sulfuric acid solution. Add 37.5 milliliters of concentrated H_2SO_4 to an 18 liter bottle containing about 10 liters of distilled water. Dilute to 18 liters and mix thoroughly. Standardize using sodium carbonate and methyl orange or methyl red indicator. This solution should have a concentration of slightly greater than .0715 normal. After exact normality is known calculate amount of water needed to make normality exactly .0715.

7. Zinc, granular, 20 mesh (or mossy Zn).

Procedure:

Weigh 2 to 10 grams of soil, depending upon the amount of organic matter. Samples of soil that are very high in organic matter will require only a 2-gram sample while the ordinary mineral soil will require 10. Sometimes it is desirable to use only 5 grams of soils that are extremely high in lime. A 10-gram sample of high-lime soil quite often causes excessive frothing and bumping during distillation and digestion. The sample is weighed into an 800-ml Kjeldahl flask followed by the addition of a teaspoonful (approx. 10 grams) of digestion mixture. With a free-flowing wash bottle containing distilled water, wash down the neck of the flask adding enough water to thoroughly soak all of the contents of the flask (15-20 ml). Add 25 ml of concentrated sulfuric acid for plant material and 35 ml for soil. Place on digestion heater and boil until conversion of all nitrogen is complete. This takes about one-half hour (at least 15 minutes after solution clears). Digestions of soil vary somewhat in color but should show evidence of all of the organic matter having been mineralized.

Thoroughly wetting the sample with water prior to addition of acid results in a little higher recovery of nitrogen than does adding the acid to the dry soil.

If digestion is carried so far that upon cooling, the contents of the flask solidify into a cake, most likely some nitrogen has been lost. If such a long digestion time is required, more acid should be added in the beginning.

After the flask and contents have cooled add about 400 ml of distilled water. Mix thoroughly. The analysis may be suspended at this point if the flasks are stoppered to exclude NH_3 contamination. From a dispensing burette add 75-100 ml of concentrated sodium hydroxide solution depending upon the amount of acid used in the beginning. The hydroxide should be allowed to run down under the solution in the flask. Add about a gram of zinc. Connect the flask to the distilling tube under which has been placed a 500-ml Erlenmeyer containing 50 ml of the boric acid solution. Swirl the Kjeldahl flask gently to mix the hydroxide and the acid solution. Enough hydroxide should have been added to make sure the contents are definitely alkaline after mixing. Generally it is advisable to turn the heater on shortly before adding the hydroxide so that the flask is placed on a hot heater. Continue the distillation until about 150-200 ml have distilled into the receiving flask. Watch carefully in the beginning to avoid frothing and carry-over of liquid into the distilling condenser. Titrate the contents of the receiving flask with the standard .0715 N H_2SO_4 to the neutral gray color established for the indicator. Correct for a blank run in the same manner, omitting only the sample.

Calculations:

% N in sample = (ml .0715 N H_2SO_4–blank) x F x M

where F = sample size factor

g sample	F
1	0.10
2	0.05
5	0.02
10	0.01

and M = moisture factor

For soils $M = \frac{100 + \% \text{ moisture}}{100}$

For plants $M = \frac{100}{100 - \% \text{ moisture}}$

(Generally, plant samples are air-dried or oven-dried at 70 C and no M correction is needed.)

Indicator solution:

Dissolve 350 milligrams of bromcresol green in 10 ml of 95% ethyl alcohol in sodium hydroxide and about 200 ml of distilled water. Add 22.1 ml of an aqueous 1% solution of new coccine and then add 750 mg of p-nitro phenol which has been dissolved in a few milliliters of 95% ethyl alcohol. This coccine solution should be mixed separately in a 250 ml graduate and finally diluted to the mark with distilled water. Test a few drops of the indicator in an acetate or pthalate buffer at pH 4.6. If the light gray color is not completely neutral as seen by the type of light to be used in subsequent titration, add small amounts of the new coccine solution or bromecresol green solution, as the case may be to one milliliter portions of the solution and retest with the buffer. When the color is neutral gray correct the bulk of the indicator by a proportionate amount of either the bromecresol green or the new coccine solution.

Nitrate - Nitrogen.

Reagents:

1. Copper sulfate, 1N. Dissolve 125 grams of $CuSO_4.5H_2O$ in 1 litter H_2O. (or 80.0g. $CuSO_4$ per liter)
2. Silver sulfate 0.6% (.02N). Dissolve 6 grams Ag_2SO_4 in 1 liter H_2O. (Heating this solution will help it to dissolve more readily.)

3. Nitrate extraction solution. Mix 200 ml of 1 and 1 liter of 2, and dilute to 10 liters.

4. Phenol Disulphonic Acid. Dissolve 100 grams of pure phenol (crystal white in color) in 600 ml of concentrated H_2SO_4. Then add 300 ml of fuming H_2SO_4 (13-18% SO_3). Mix and heat on steam bath for 2 hours. When cool, store in amber bottle. CAUTION: This reagent is highly corrosive.

5. Calcium hydroxide, powder, nitrate-free.

6. Magnesium carbonate, powder, nitrate-free.

7. Sodium hydroxide - EDTA solution. Dissolve 360 g of sodium hydroxide and 15 g of the disodium salt of ethylene diammine tetracetic acid in 1000 ml of water. (The technical grade of EDTA supplied by the Dow Chemical Company, Framingham, Mass., has proved satisfactory.)

8. Standard nitrate solution, stock. (100 μg N/ml). Dissolve 0.7221 grams of KNO_3 in water, and dilute to 1 liter. Store in refrigerator. (Should remain stable for at least 6 months).

9. Working standards. Dilute 8 as follows:

ml stock for 500 ml of standard	conc. of standard μg N/ml	μg N in 5-ml aliquot
5	1	5
10	2	10
20	4	20
35	7	35
50	10	50
75	15	75

Procedure:

Weigh 15 g of prepared soil sample into a 200 ml Erlenmeyer flask. Add 75 ml of reagent 3 and shake for 10 minutes. Add about 0.2 g of reagent 5 (one small lime scooper full) and shake for 5 more minutes. Add about 0.5 g of reagent 6 (one large scooper full) and shake for at least 4 more minutes. Allow to stand for awhile for soil to settle, then filter through E & D No. 512 fluted paper and clean funnels, discarding the first 15-20 ml of extract.

Prepare a blank in the same manner, omitting only the soil.

Pipet 20 ml aliquot of each sample, and 5 ml of each working standard into a 150 ml beaker and evaporate to dryness on a steam bath. Cool and add

3 ml of reagent 4 rapidly around beaker; rotate beaker so that acid contacts all residue. After a few minutes, rotate beakers again.

Allow the beaker to stand for 10 minutes; if there is still some undissolved residue in the beaker use a glass stirring rod to break up the residue and speed the reaction. When solution is complete add 25 ml of distilled water.

Add 15 ml of reagent 7 solution and mix again. Allow to cool and measure the color at 440 mu. Compare to a calibration curve established by carrying (0-75 mg of N) through the above procedure beginning with the evaporation step.

(Note: If solution color is not stable, add a small amount of KCN)

Calculations:

Plot the standard curve (%T vs. μg N in aliquot, using semilog paper).

Read μg N in aliquot for each sample.

Calculate μg N per g of soil sample (ppm N):

$$\text{ppm N} = \frac{(\mu\text{g N in aliquot}) \times (\text{total ml of extractant})}{(\text{ml of aliquot}) \times (\text{g of soil})}$$

If procedure above is followed exactly, (15 g → 75 ml → $\underline{\underline{20}}$ ml aliquot); then (μg N in aliquot) x .25 = ppm N in soil.

For reruns - if color goes off-scale, take a smaller aliquot from the filtrate and start at the evaporation step.

Total Ammonium Nitrogen. (Fixed NH_4^+-N and Exchangeable NH_4^+-N)

Four grams of soil was placed in a semi-micro Kjeldahl flask and steam distilled with 20 ml of 40% NaOH. The ammonium-nitrogen was collected in

5 ml of 2% H_2BO_3 containing three drops of Tashiro's indicator. This was titrated to the endpoint with the primary standard 0.01 N KH (IO_3). The ml of titrant multiplied by the normality gives the milliequivalents (meq) of N in the sample. The meq weight of N is 14 mg/meq and when multiplied by the meq gives the mg of N in the sample.

Nitrogen (N_2) Fixation Potential.

The N_2 fixation potential was determined by the acetylene reduction assay from the method of Stewart, Fitzgerald and Burns (1967). Soil samples were prepared by adding two grams of surface soil (0-3 cm) to 13 x 60 mm glass tubes sealed at the bottom with a rubber stopper. Each sample was moistened with 1.0 ml of distilled water, and capped with injectable serum stoppers; 0.6 ml acetylene (Muthesen Co.) was injected into each sample tube resulting in a concentration of 0.1 atmosphere.

At that concentration of acetylene, competitive inhibition by nitrogen (N_2) is eliminated. Each soil core was then placed 15 cm from an incandescent light source for 24 hours at 23° C.

For the determination of ethylene, a 0.2 ml gas sample was withdrawn and injected into a Varian gas chromatograph, series 1740, with a flame injection detector. Helium was used as a carrier gas with a flow rate of approximately 25 ml per minute with a 2.74 m Porapak R column, 100 to 120 mesh, at 50° C. The injection temperature was set at 55° C, and the hydrogen flame detector at 90° C. The attenuation of the G.C. was at 1 and at a range of 10^{-4} for the reading of most ethylene peaks.

A Varian model 20 strip chart recorder was used for reading of the ethylene peaks, with a chart speed of 25 cm/hr. The concentration of ethylene was then determined from a standard curve using pure ethylene (Muthesen Co.).

The computation of nitrogen fixation potential is as follows: The crust surface area of the soil tubes was 1.324 x 10^{-8} hectors. The following assumption was made in order to estimate N_2 fixed by acetylene reduction:

$$C_2H_2 \xrightarrow{2e^-} C_2H_4$$

$$N_2 \xrightarrow{6e^-} 2NH_3$$

Therefore, 1.0 nanomole C_2H_4 produced equals 9.33 x 10^{-9} grams of nitrogen fixed. Multiplying the nanomole found in the 0.2 ml gas sampled analyzed by 30 yields the total nanomoles produced in an assay. Nanomole s C_2H_4 x 0.7046 equals grams nitrogen (N_2) fixed per hectore.

To summarize:

$$\text{mm (peak height)} \times \frac{1.5 \text{ nanomole } C_2H_4}{100} \times 30 \times 0.7046 =$$

grams nitrogen (N_2) fixed per hectore

Soil Moisture Content.

10 grams of each soil sample was placed into weighing bottles. With lids ajar the bottles were placed in a drying oven at 110° C. After 3 days the samples were removed, allowed to cool, and reweighed. The amount of weight loss was calculated as the number of grams of water per 100 g of soil.

$$\frac{\text{Moist Weight} - \text{Dry Weight}}{\text{Dry Weight}} \times 100 = \%\ \text{Moisture}$$

Soil pH.

Weigh 5 grams of each sample into a 15 ml beaker, adding 5 ml of distilled water and stirring the contents. After standing approximately ten minutes, the contents were swirled, and pH was read with a Beckman pH meter using

small electrodes.

Water Potential Measurement.

Soil water potential was measured using a Wescor, Inc., Model MJ55 psychrometric microvoltmeter with a Model C-51 sample chamber psychrometer (Brown and Van Haveren, 1972; Wiebe, et al., 1971; Robinson and Stokes, 1949; Lang, 1967; Campbell and Gardner, 1971).

Operation of MJ55:

1. Take a temperature reading by connecting the copper thermocouple wire to the red binding post, and the constanton wire to the blue binding post.
    a. Turn the range switch to 1 millivolt full scale.
    b. With the power switch in the "on" position and the reference junction switch in the "up" position, the meter will read the voltage corresponding to the temperature.
    c. The voltage reading can be converted to °C using Table 3.
2. For sample reading, turn reference junction switch off (down) and disconnect the copper thermocouple and constanton wires.
3. Connect the sample chamber by placing the copper thermocouple wire in the red binding post and the silver wire in the blank binding post.
4. Turn range switch to proper scale (10, 30, 100 or 300 volts)
5. Turn power switch to "on".
6. Make a preliminary check on meter operation (i.e. battery check, other switches). Check sample chamber by positioning slide in sample chamber (move slide slowly as not to contaminate thermocouple). Switch to cool and read. The meter should return to "0" in a few seconds. If the chamber is wet, the reading may go to 400 μ volts. Wait for it to return to "0".
7. Switch the meter to zero check and check "zero" position if necessary.
8. Place a distilled water saturated chromatograph paper disk in shallow sample holder and place in left hand position in slide of sample chamber. Slide slowly into place beneath the thermocouple, tighten knob, and cool for 1.5 minutes. (Cool switch down).

TABLE 3

Copper Constantan Conversion Chart

(Temperatures in Degrees C, Reference Junctions at 0°C)

°C	0	1	2	3	4	5	6	7	8	9
	Millivolts									
(+)0	0.000	0.038	0.077	0.116	0.154	0.193	0.232	0.271	0.311	0.350
10	0.389	0.429	0.468	0.508	0.547	0.587	0.627	0.667	0.707	0.747
20	0.787	0.808	0.827	0.908	0.949	0.990	1.030	1.071	1.112	1.153
30	1.194	1.235	1.277	1.318	1.360	1.401	1.443	1.485	1.526	1.568
40	1.610	1.652	1.694	1.737	1.779	1.821	1.864	1.907	1.949	1.992

9. Prepare sample in another sample holder by filling the holder. Fill 2/3 of the holder, making sure the surface of the soil is smooth and there is no debris outside the center of the sample holder.

10. Place the prepared sample holder in the right hand position of the slide and place a 00 rubber stopper on the top of the soil.

11. After cooling 1.5 minutes:

    a. Switch to zero check and check "zero" position, adjust.

    b. Switch back to the "on" position.

    c. After removing the rubber stopper, slowly slide the sample to the thermocouple position, wait for meter to go to 100 or 300 μv for dry soil, less if it is wet, then tighten knob completely.

12. Note and record reading at which meter remains stable, when it reaches a plateau (In a dry soil, this plateau may last only a few seconds.)

13. Allow meter to equilibrate while soil sample is in sample chamber, then repeat cooling with water disk and prepare another sample.

14. After use, remove sample holder from tray so that thermocouple is dry during storage. Turn off instrument.

Cleaning MJ55 Sample Chamber Psychrometer:

1. Remove the 2 allen head screws on the upper side of the chamber and carefully separate the top and bottom halves of the sample chamber.

2. The thermocouple chamber is at the center of the nickel plated core. It's very tiny--be sure not to break it.

3. Wipe the Viton O-ring and the surrounding area with a wet swab.

4. Then, chamber facing up, put a few drops of acetone in the chamber and blow it out with Dry-Blow (Wescor). Repeat twice.

5. Place a few drops of distilled water in the chamber and blow it out with Dry-Blow. Repeat twice.

6. Be sure it is dry in and around chamber. Put the parts back and be sure it is clean, ready for using.

Standard Calibration Curve.

NaCl standard calibration curve: It is for wet soil. The water potentials

are between 0 and -100 bars. The stock solution was prepared according to Table 4 as shown in Table 5. For our measurements, standard solutions were made up at room temperature, 22° to 23° C. The temperature of the chamber was first read and then of the solution. Equilibration time between chamber and solution was 1.5 minutes. The output was essentially linear (Table 6). The relationship between the water potential and NaCl solution concentrations as a function of temperature is shown in Table 7.

LiCl standard calibration curve: It is used for measuring extremely low potentials, as low as -800 bars. The lithium chloride concentrations for solutions having water potentials ranging from -100 to -1000 bars calculated for 22° C had an equilibration time between chamber and solution of 1 1/2 minutes. The output was linear (Table 8).

Factor for comparison of the NaCl and LiCl standard curves:

$$\text{NaCl curve} = \frac{\text{LiCl curve}}{3.65}$$

TABLE 4

Molality of NaCl	Mass of 2 M stock solution	Mass of Water	Total Mass
0.1	55.84	950.00	1005.84
0.2	111.69	900.00	1011.69
0.3	167.53	850.00	1017.53
0.4	223.38	800.00	1023.38
0.5	279.32	750.00	1029.22
0.6	335.07	700.00	1035.07
0.7	390.91	650.00	1040.91
0.8	446.76	600.00	1046.76
0.9	502.60	550.00	1052.60
1.0	558.45	500.00	1058.45
1.5	837.67	250.00	1087.67
2.0	1116.90	0.00	1116.90

TABLE 5

NaCl solutions for the Calibration Curve

Mass of NaCl	NaCl g/50 ml distilled water
0.05	0.15
0.1	0.29
0.2	0.59
0.5	1.46
0.7	2.05
0.9	2.63
1.0	2.92
1.1	3.21
1.3	3.79
1.5	4.88
1.7	4.97
1.9	5.52
2.0	5.85

TABLE 6

NaCl Standard Solution

Molality of NaCl	Ave. µv	Water Potential (-Bars)
0.05	3.5	2.34
0.1	14.5	4.62
0.2	18.5	9.15
0.5	35.0	22.81
0.7	44.0	32.10
0.9	49.0	41.58
1.0	56.0	46.40
1.1	66.0	51.27
1.3	70.0	61.19
1.5	80.0	71.34
1.7	96.0	81.70
1.9	110.0	92.40
2.0	120.0	97.80

TABLE 7

Water Potentials of NaCl solutions (Lang, 1967) at

temperatures between 0-40 C

	Water Potential (J/Kg)								
Molality	0^0C	5^0C	10^0C	15^0C	20^0C	25^0C	30^0C	35^0C	40^0C
0.05	-214	-218	-222	-226	-230	-234	-238	-242	-245
0.1	-423	-431	-439	-447	-454	-462	-470	-477	-485
0.2	-836	-852	-868	-884	-900	-915	-930	-946	-961
0.3	-1247	-1272	-1297	-1321	-1344	-1368	-1391	-1415	-1437
0.4	-1658	-1693	-1727	-1759	-1791	-1823	-1855	-1886	-1917
0.5	-2070	-2115	-2158	-2200	-2241	-2281	-2322	-2362	-2402
0.6	-2484	-2539	-2593	-2644	-2694	-2744	2794	-2843	-2891
0.7	-2901	-2967	-3030	-3091	-3151	-3210	3270	-3328	-3385
0.8	-3320	-3398	-3472	-3543	-3612	-3682	-3751	-3818	-3885
0.9	-3743	-3832	-3917	-3998	-4079	-4158	-4327	-4314	-4390
1.0	-4169	-4270	-4366	-4459	-4550	-4640	-4729	-4815	-4001
1.1	-4599	-4713	-4820	-4924	-5026	-5127	-5226	-5322	-5418
1.2	-5032	-5160	-5278	-5394	-5507	-5620	-5730	-5835	-5941
1.3	-5470	-5611	-5742	-5869	-5994	-6119	-6239	-6354	-6471
1.4	-5912	-6068	-6210	-6350	-6487	-6623	-6754	-6880	-7006
1.5	-6359	-6529	-6684	-6837	-6986	-7134	-7276	-7411	-7548
1.6	-6811	-6996	-7163	-7330	-7491	-7652	-7805	-7950	-8007
1.7	-7260	-7460	-7640	-7820	-8000	-8170	-8330	-8490	-8650
1.8	-7730	-7940	-8130	-8330	-8520	-8700	-8880	-9040	9210
1.9	-8190	-8430	-8630	-8840	-9040	-9240	-9430	-9600	-9780
2.0	-8670	-8920	-9130	-9360	-9570	-9780	-9980	-10160	-10350

TABLE 8

LiCl Standard Solution

LiCl (Molality)	Ave. (μv)	Water Potential (-Bars)
1.81	40	-100
4.12	112	-300
6.49	180	-600
8.85	280	-1,000

D. RAW DATA FROM FLUSHING TRANSECTS - REPTILES

EPTILES SITE: RIPARIAN OBSERVER: TWS MO.: 6-8 YR.: 7

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
6	4	NORTHERN PLATEAU LIZARD			0	0	0	1	5	-6	pm	1	
					0	0	0	2				1	
7	9				0	0	0	3	9	-	11	1	
					0	0	0	4				1	
					0	0	0	5				1	
7	10				0	0	0	6	9	-	11	1	OBSERVED 2
					0	0	0	2				2	
8	7				0	0	0	7	9-	10:	10	1	OBSERVED 7
					0	0	0	8				1	
					0	0	0	9				1	
					0	0	0	10				1	
	15								12:15-12:45				NONE OBSERVED

ILES SITE: OBSERVER: MO.: 6-8 YR.:

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
6	4	NORTHERN SIDE-BLOTCHED LIZARD			0	0	0	1	5	-6	pm	1	
7	9								9	-	11		NONE OBSERVED
7	10								9	-	11		OBSERVED 3
8	7								9-	10:	10		NONE OBSERVED
8	15								12:	15-	12:45		NONE OBSERVED

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
6	4	TREE LIZARD			0	0	0	1	5	-	6pm	1	OBSERVED 4
					0	0	0	2				1	
7	9				0	0	0	3	9	-	11	1	
					0	0	0	4				1	
					0	0	0	5				1	
					0	0	0	6				1	
7	10				0	0	0	7	9	-	11	1	OBSERVED 2
8	7								9	-10:10			OBSERVED 1
8	15				0	0	0	8	12:15-12:45				

EPTILES SITE: GREASEWOOD OBSERVER: TWS MO.: 6-8 YR.: 7

ONTH DAY		SPECIES	AGE	SEX	TOE CLIP				TIME #			CAP. #	COMMENTS
6	4	NORTHERN SIDE-BLOTCHED LIZARD			0	0	0	1	11	-	12	1	OBSERVED 3
7	10								5	-	5:30		NONE OBSERVED
7	11								11	-	12		NONE OBSERVED
	5								12	-	1:30		NONE OBSERVED
	6								8:30	-	9:30		NONE OBSERVED
	13				0	0	0	2	10:30	-	11:45	1	
	14								11	-	12		NONE OBSERVED

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
6	4	NORTHERN WHIPTAIL							11 - 12		OBSERVED 5
7	10								5-5:30 pm		NONE OBSERVED
7	11								11 - 12		OBSERVED 4
8	5				0	0	0	1	12-1:30	1	OBSERVED 3
8	6								8:30-9:30		OBSERVED 1
8	13				0	0	0	2	10:30-11:45		OBSERVED 4
					0	0	0	3			
					0	0	0	4			
8	14				0	0	0	5	11 - 12		OBSERVED 3
					0	0	0	6			

ET TILESSITE: SHADSCALE OBSERVER: TWS MO.: 6-8 YR.: 75

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
6	2	Northern Plateau Lizard			0	0	0	1	12	-	1	1	
					0	0	0	2				1	
					0	0	0	3				1	
7	8				0	0	0	4	9	-10	:15	1	
					0	0	0	5				1	
	5				0	0	0	6	9-	9:	45	1	OBSERVED 3
					0	0	0	7				1	
	6				0	0	0	8	11	-	12	1	OBSERVED 3.
	8				0	0	0	9	10	-11	:20	1	
					0	0	1	0				1	
					0	0	1	1				1	
	11				0	0	0	7	12:40	-1	:30	2	
	12								11	-	12		NONE OBSERVED
	13								1:45	-2	:30		NONE OBSERVED
	14								2:45	-3	:15		NONE

EPTILES SITE: SHADSCALE OBSERVER: TWS MO.: 6-8 YR.: 75

ONTH DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
2	SAGEBRUSH LIZARD			0	0	0	1	12	-	1	1	OBSERVED 6
				0	0	0	2				1	
				0	0	0	3				1	
8				0	0	0	4	9	- 10	:15	1	
5								9	- 9:	45		NONE OBSERVED
6				0	0	0	5	11	-	12	1	
8				0	0	0	6	10	- 11:	20	1	
				0	0	0	7				1	
				0	0	0	8				1	
				0	0	0	9				1	
				0	0	0	10				1	
				0	0	0	11				1	
				0	0	0	3				2	
				0	0	0	4				2	
11				0	0	0	12	12:40-1:30			1	OBSERVED 5
12				0	0	0	13	11	-	12		OBSERVED 8
				0	0	0	14					
				0	0	0	15					
				0	0	0	7				2	
13				0	0	0	16	1:45-2:30			1	OBSERVED 4
				0	0	0	5				2	
14				0	0	0	4	2:45-3:15			2	

ILE SITE: [illegible] OBSERVER: [illegible] MO.: [illegible] YR.: 75

ONTH DAY	SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
2	NORTHERN SIDE-BLOTCHED LIZARD			0	0	0	1	12 - 1	1	observed 7
				0	0	0	2		1	
				0	0	0	3		1	
				0	0	0	4		1	
8				0	0	0	5	9-10:15	1	OBSERVED 7
5				0	0	0	6	9-9:45	1	
6								11 - 12		NONE OBSERVED
8				0	0	0	7	10-11:20	1	
				0	0	0	8		1	
11				0	0	0	9	12:40-1:30	1	
				0	0	1	0		1	
12								11 - 12		1 observed
13								1:45-2:30		2 OBSERVED
14								2:45-3:15		NONE OBSERVED

EPTILES SITE: SHADSCALE OBSERVER: TWS MO.: 6-8 YR.: 75

ONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
8	14	MOUNTAIN SHORT-HORNED LIZARD			0	0	0	1	2:45-3:15	1	OBSERVED 2

EPTILES SITE: SHADSCALE OBSERVER: TWS MO.: 6-8 YR.: 75

ONTH DAY	SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
2	NORTHERN WHIPTAIL			0	0	0	1	12 - 1	1	OBSERVED 2
8								9-10:15		NONE OBSERVED
5								9-9:45		NONE OBSERVED
6				0	0	0	2	11 - 12	1	
[illegible]				0	0	0	3		1	
8				0	0	0	4	10-11:20	1	OBSERVED 3
11				0	0	0	5	12:40-1:30	1	
				0	0	0	6		1	
12				0	0	0	7	11 - 12	1	OBSERVED 4
				0	0	0	8		1	
13								1:45-2:3		1 OBSERVED
14								2:45-3:15		NONE OBSERVED

EPTILES SITE: SHADSCALE OBSERVER: TMS MO.: 6-8 YR.: 75

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
	2	TREE LIZARD			0	0	0	1	12	-	1	1	
7	8								9	-10	15		NONE OBSERVED
	5								9	- 9:	45		NONE OBSERVED
8	6								11	-	12		NONE OBSERVED
	8								10	- 11	20		NONE OBSERVED
	11								12:	40-	1:30		NONE OBSERVED
	12								11	-	12		NONE
	13								1:4	5-2	:30		NONE
	14								2:4	5-3	:15		NONE

EPTILES SITE: PINYON - JUNIPER OBSERVER: TWS MO.: 8 YR.: 75

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
		NORTHERN WHIPTAIL									
6	3								12 to 1:30		none observed
7	8								10:30 to 11:30		none observed
8	5								10 to 10:45		one observed
	6				0	0	0	1	10 to 10:35	1	
					0	0	0	2		1	
8	8								11:30-12:00		NONE OBSERVED
	11								11:45-12:30		NONE OBSERVED
	12								11:30-12:05		NONE OBSERVED
	13								12 to 1:30		ONE OBSERVED

EPTILES SITE: Pinyon-Juniper OBSERVER: TWS Mo.: 8 YR.: 75

MONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
6	3	NORTHERN PLATEAU LIZARD			0	0	0	1	12	-	2	1	
					0	0	0	2				1	
7	8								10:30-11:30				none observed
	5								10	-	10:45		none observed
	6								10	-	10:35		none observed
	8								11:50	-	12:10		none observed
	11								11:45	to	12:30		none observed
	12								11:30	to	12:05		1 observed
	13								12	to	1:30		None observed

EPTILES SITE: PINYON - JUNIPER OBSERVER: TWS MO.: 8 YR.: 75

ONTH	DAY	SPECIES	AGE	SEX	TOE CLIP				TIME			CAP. #	COMMENTS
	3	Sagebrush Lizard			0	0	0	1	12	to	2	1	
7	8							–	10:30	to	11:30		none observed
8	5				0	0	0	2				1	observed 5
					0	0	0	3				1	
					0	0	0	4				1	
	6								10	to	10:35		none observed
	8								11:50-12:00				none observed
8	11				0	0	0	5	11:45-12:30			1	observed 3
					0	0	0	6				1	
	12				0	0	0	7	10:30	to	11:15	1	observed 4
					0	0	0	3				2	
	13				0	0	0	8	12-1:30			1	

EPTILES SITE: PINYON-JUNIPER OBSERVER: TWS MO.: 8 YR.: 75

MONTH DAY		SPECIES	AGE	SEX	TOE CLIP				TIME	CAP. #	COMMENTS
[illegible]	3	NORTHERN SIDE-BLOTCHED LIZARD			0	0	0	1	12 - 1:30	1	OBSERVED 8
					0	0	0	2		1	
					0	0	0	3		1	
					0	0	0	4		1	
7	8				0	0	0	5	10:30 to 11:30	1	observed 3
					0	0	0	6		1	
[illegible]	5				0	0	0	7		1	
					0	0	0	8		1	
					0	0	0	9		1	
					0	0	0	10		1	
					0	0	0	11		1	
					0	0	0	12		1	
[illegible]	6				0	0	0	13	10-10:35	1	observed 2
[illegible]	8				0	0	0	2	11:30-12:00	2	
[illegible]	11				0	0	0	2	11:45-12:30	3	
[illegible]	12				0	0	0	14	11:30 to 12:05	1	observed 3
[illegible]	13				0	0	0	15	12 - 1:30	1	
					0	0	0	16		1	

E. TERRESTRIAL VERETEBRATES

UTAH STATE DIVISION OF WILDLIFE RESOURCES
MONTHLY SUMMARY OF ACTIVITIES

AP-1.1
4-74

Employee Jeff Grandison Month June 19 75

NON-FEDERAL AID ACTIVITIES:	Miles	Hours
LAW ENFORCEMENT		11
Arrests No.		
Licenses Checked No.	Odometer Broken	
Other Law Enforcement Agency Activities:		
GAME MANAGEMENT		
GAME CONTROL		1
FISHERIES MANAGEMENT		5
INFORMATION AND EDUCATION		

	Number	Adults	Youths
School Programs			
Lectures			
Hunter Safety Classes			
Tours of Installation			
Visitors to Installations			

Press Contacts ______ Releases ______
Radio Station Contacts ______ Programs ______

~~FIELD SERVICES~~ Project 5C-115 ______ 172
Total 189

FEDERAL AID PROJECTS	Vehicle No.	Miles	Fed. Aid Days

Annual Leave: No. Days 2, Dates 12, 13

Sick Leave: No. Days ______, Dates ______

FOR EMPLOYEE COMMENTS AND ADDITIONAL INFORMATION USE OTHER SIDE

Employee   Month   19

Activity	Miles	Hours

Day 1 Time Started 7:30 am Time Ended 7PM Lic. Checked 75 Veh. No. 1145 Beg. Mileage

Narrative: Worked opener of Utah fishing season

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 2 Time Started 7:30 Time Ended 6PM Lic. Checked Veh. No 1145 Beg. Mileage

Narrative: Worked on tuning transmitters

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 3 Time Started 7:30 Time Ended 5:30 Lic. Checked Veh. No 1145 Beg. Mileage

Narrative: Worked on tuning and waterproofing transmitters.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Employee   Month   19

Activity	Miles	Hours

Day 4 Time Started 4:30 am Time Ended 5PM Lic. Checked Veh. No 1145 Beg. Mileage

Narrative: Ran deer route from Bonanza through Tract. Wrote monthly reports. Worked on transmitters.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 5 Time Started 6:30 am Time Ended 5PM Lic. Checked Veh. No 1145 Beg. Mileage

Narrative: Looked for deer on White River near Southam Bound, OZ on river. Checked Asphalt Wash.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 6 Time Started 7AM Time Ended 4PM Lic. Checked Veh. No. 1145 Beg. Mileage

Narrative: Looked for deer at Evac x Hill Hole [illegible] office to check on assignments.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Employee Month 19

Activity	Miles	Hours

Day 7 Time Started Time Ended Lic. Checked Veh. No. Beg. Mileage

Narrative: Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Day 8 Time Started 7AM Time Ended 6PM Lic. Checked Veh. No. 1145 Beg. Mileage

Narrative: Met Clair at office + picked up a new receiver. Checked Mount receiver. Looked for deer on tract. Compedant.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 9 Time Started 7AM Time Ended 5PM Lic. Checked Veh. No. 1145 Beg. Mileage

Narrative: Checked for deer at Asphalt Wash. Found .09 on River. Returned to Vernal.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee Month 19

Activity	Miles	Hours

Day 10 Time Started 7AM Time Ended 5PM Lic. Checked Veh. No. 1145 Beg. Mileage

Narrative: On White River to Check for deer. Found .06, .02, .07. Couldn't find .05 + .03. Finished several reports in office.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 11 Time Started 7AM Time Ended 6PM Lic. Checked Veh. No. 1145 Beg. Mileage

Narrative: To Heber to sign complaint. Picked up radio parts in SLC.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 12 Time Started Time Ended Lic. Checked Veh. No. Beg. Mileage

Narrative: Annual Leave

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Day 13 Time Started____ Time Ended____ Lic. Checked____ Veh. No.____ Beg. Mileage____

Narrative: Annual Leave.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 14 Time Started____ Time Ended____ Lic. Checked____ Veh. No.____ Beg. Mileage____

Narrative: Off

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 15 Time Started____ Time Ended____ Lic. Checked____ Veh. No.____ Beg. Mileage____

Narrative: Off

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ________ Month ________ 19____

Day 16 Time Started 8 AM Time Ended 5 PM Lic. Checked____ Veh. No. 1145 Beg. Mileage____

Narrative: Finished quarterly report & sent off. Talked to Nelson about Regional Wildlife Report for VTN.

Activity	Miles	Hours
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		7
Other		
Totals		7

Day 17 Time Started 8:30 Time Ended 11:30 pm Lic. Checked____ Veh. No. 1145 Beg. Mileage____

Narrative: Got gear ready for coyote - cat trapping. Made out requests for supplies. Compiled data on lek activity & "sightings". Attended pre-advisory panel meeting in Vernal

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		11
Other		
Totals		11

Day 18 Time Started 8:30 Time Ended 5PM Lic. Checked____ Veh. No. 1145 Beg. Mileage____

Narrative: Met Monarch in office re: regional report. Met with Clair Huff about report. Attended Advisory Panel meeting. Got radio installed in truck.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		7
Other		
Totals		7

Use back of sheet where more space is needed. Be sure to indicate date!

Day 19 Time Started 7 AM Time Ended 5 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Gave talk to groups on tract about project. Looked for deer above Hell Hole found .05 at Cowboy Hole. found .06 at Evan pipeline.

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. 50-115
Other ______
Totals

Day 20 Time Started 7 AM Time Ended 5 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Looked for deer at Southam found .01 above ST-4.

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. 50-115
Other ______
Totals

Day 21 Time Started ______ Time Ended ______ Lic. Checked ______ Veh. No. ______ Beg. Mileage ______

Narrative: Off

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. ______
Other ______
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ______ Month ______ 19___ Activity Miles

Day 22 Time Started ______ Time Ended ______ Lic. Checked ______ Veh. No. ______ Beg. Mileage ______

Narrative: Off

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. ______
Other ______
Totals

Day 23 Time Started 7:30 AM Time Ended 5 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Saw Willie Stevens about trapping. Worked on traps and drags.

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. 50-115
Other ______
Totals

Day 24 Time Started 6 AM Time Ended 6 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Met Bob Elsterkamp & Chuck on tract. Monitored deer above [illegible]. .06 had two fawns.

Law Enforcement ______
Game Management ______
Game Control ______
Fisheries Management ______
I & E ______
Field Services ______
F.A. Proj. 50-115
Other ______
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Day 25 Time Started 7:30 AM Time Ended 5PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: On trip to Cook's Garden, [illegible] below Jensen. Saw several in uplands. Found .07. Did plant phenology studies.

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
50-115
Other ____
Totals

Day 26 Time Started 7AM Time Ended 5:30 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Worked on plant phenology studies. Truck broke down & had to be towed in.

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
50-115
Other ____
Totals

Day 27 Time Started 8:30 AM Time Ended 5PM Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: In office to see Claire Huff. Worked on report. Checked out traps, transmitters and gear for trapping program. Got deer out of canal at Steinaker Reservoir

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
50-115
Other ____
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19__

Activity Miles Ho

Day 28 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Day 29 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Day 30 Time Started 7AM Time Ended 5:30 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Met Willie Stevens & worked on gear, got groceries etc. ready. Went to Roosevelt to pick up 4WD truck

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
50-115
Other ____
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
6/5	Mouth of Southam Canyon on North side of River Riparion	Radio	0.02	
6/9	One half mile upstream from mouth of Asphalt Sagebrush-shadscale	Radio & Ocular	0.09 and two additional does	No fawns seen
6/10	One half mile above Evacuation pipeline crossing. Riparion	Radio	0.06	
	One mile downstream from X-2. Riparion	Radio & Ocular	0.02	
	One mile downstream from X-2. Riparion	Radio & Ocular	0.07 and one deer of unknown sex	Not with 0.02
6/19	Cowboy hole on south side of river. Riparion	Radio & Ocular	0.05 & 3 additional deer of unknown sex	
	One mile above Evacuation pipeline. Riparion	Radio	0.06	

DATE	CATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
6/20	One mile below X-2 on north side of river Riparion	Radio	0.01	
	One eighth (1/8) mile above Evacuation pipeline. Riparion	Radio	0.06	
6/24	Cowboy Hole Riparion	Radio	0.05	
	One fourth (¼) mile above Evacuation pipeline. Riparion	Radio & Ocular	0.06	Had two fawns following
6/25	One mile downstream from X-2. Riparion	Radio	0.07	
6/26	One half mile above Evacuation pipeline. Riparion	Radio & Ocular	0.06	Saw both fawns. Shaded up under ledges.

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
6/19	One half mile west of S-1. Sagebrush -shadscale	Ocular	Two does and one buck	No collars No fawns
6/24	Mouth of Evacuation Wash. Riparion	Ocular	Four does	No collars No fawns
6/24	One fourth mile upstream from mouth of Cowboy Hole Riparion	Ocular	One doe	No collars No fawns
6/25	One fourth mile uproad from Wagon Hound to A-3. Sage-Juniper	Ocular	One buck and one doe	No collars No fawns
	One mile north on road from A-10. Sage-shadscale	Ocular	One buck	No collar
	One and one half mile north on road from A-10 Sage-shadscale	Ocular	One buck	No collar Under ledges in canyon
6/26	Between X-2 and river Greasewood	Ocular	Two does	No collars No Fawns Under ledges in wash

UTAH STATE DIVISION OF WILDLIFE RESOURCES
MONTHLY SUMMARY OF ACTIVITIES

AP-1.1
4-74

Employee Jeff [illegible] Month July 19 75

NON-FEDERAL AID ACTIVITIES:	Miles	Hours
LAW ENFORCEMENT	-	-
Arrests ... No.		
Licenses Checked ... No.		
Other Law Enforcement Agency Activities:		
GAME MANAGEMENT		
GAME CONTROL		
FISHERIES MANAGEMENT		
INFORMATION AND EDUCATION		

	Number	Adults	Youths
School Programs			
Lectures			
Hunter Safety Classes			
Tours of Installation			
Visitors to Installations			

Press Contacts ______ Releases ______
Radio Station Contacts ______ Programs ______

FIELD SERVICES Project SE-115 ([illegible]) ______ 168 / 30

FEDERAL AID PROJECTS	Vehicle No.	Miles	Fed. Aid Days
Totals	1145		21.5

Annual Leave: No. Days 0, Dates ______
Sick Leave: No. Days 0, Dates ______

FOR EMPLOYEE COMMENTS AND ADDITIONAL INFORMATION USE OTHER SIDE

DAILY ACTIVITY REPORT

4-69

Employee Jeff [illegible] Month July 19 75

RECEIVED
AUG 2 1975

Day 1 Time Started 6:30 AM Time Ended 7 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Set out coyote-bobcat traps. Worked on soil samples [illegible]

Activity	Miles	Ho
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
SE-115		1
Other		
Totals		1

Day 2 Time Started 6:30 AM Time Ended 7 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Worked on coyote trapline. Removed traps - 11 total.

Activity	Miles	Ho
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
SE-115		1
Other		
Totals		1

Day 3 Time Started 7 AM Time Ended 5 PM Lic. Checked ______ Veh. No. 1145 Beg. Mileage ______

Narrative: Ran coyote traps. [illegible] plant phenology - soil moisture studies

Activity	Miles	Ho
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
SE-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

4-69

DAILY ACTIVITY REPORT

Employee [illegible] Month Jul. 19 75

Day 10 Time Started 7 am Time Ended 5 pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Ran coyote traps. Caught & released [illegible] in Clough Ck

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj. 50-115	
Other	
Totals	

Day 11 Time Started 7 am Time Ended 5 pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Ran coyote traps & [illegible] deer 01, 05, 06

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj. 50-115	
Other	
Totals	

Day 12 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Use back of sheet where more space is needed. Be sure to indicate date!

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj.	
Other	
Totals	

4-69

DAILY ACTIVITY REPORT.

Employee [illegible] Month Jul. 19 75

Day ~~13~~ 14 Time Started 7 am Time Ended 5 pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Ran traps & looked for deer. Caught & released pup in Clough Ck. Checked collared coyote - in Clough Ck.
Monday

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj. 50-115	
Other	
Totals	

Day ~~14~~ 13 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative:
Sunday Off

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj.	
Other	
Totals	

Day 15 Time Started 7 am Time Ended 5 pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: In office in AM to work on data & reports. Put gear in ready for next trip.

Activity	Miles
Law Enforcement	
Game Management	
Game Control	
Fisheries Management	
I & E	
Field Services	
F.A. Proj. 50-115	
Other	

Employee [illegible] Month [illegible] 19[illegible]

Day 16 Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No 1145 Beg. Mileage ____

Narrative: [illegible]

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	[illegible]		1
Other			
Totals			[illegible]

Day 17 Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: [illegible] Blanchett [illegible] trip

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
Other			[illegible]
Totals			[illegible]

Day 18 Time Started 7:30 AM Time Ended 5PM Lic. Checked ____ Veh. No 1145 Beg. Mileage ____

Narrative: [illegible] Blanchett Park for trip.

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
Other			[illegible]
Totals			[illegible]

Use back of sheet where more space is needed. Be sure to indicate date!

Employee [illegible] Month July 1975

Day 19 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
Other			
Totals			

Day 20 Time Started 7AM Time Ended 6PM Lic. Checked ____ Veh. No 1145 Beg. Mileage ____

Narrative: [illegible] out of Blanchett Park.

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
Other	5		[illegible]
Totals			12

Day 21 Time Started 7:30 AM Time Ended 5PM Lic. Checked ____ Veh. No 1145 Beg. Mileage ____

Narrative: [illegible] check [illegible]. [illegible] Pulled [illegible].

Activity		Miles	Hour
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	SC-115		[illegible]
Other			

Employee __________ Month __________ 19 ____

Activity | Miles Hou

Day 22 Time Started ____ Time Ended 5pm Lic. Checked ____ Veh. No. 115 Beg. Mileage ____

Narrative: [illegible]
office
"

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
SC-115
Other
Totals

Day 23 Time Started 7:30 Time Ended 5pm Lic. Checked ____ Veh. No. 115 Beg. Mileage ____

Narrative: Worked on RLCR and office
"

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
SC-115
Other
Totals

Day 24 Time Started 7:30 Time Ended 5pm Lic. Checked ____ Veh. No. 115 Beg. Mileage ____

Narrative: Worked on RLCR and office
"

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
SC-115
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee Goodman Month July 19 75

Activity | Miles Hou

Day 25 Time Started 7:45 Time Ended 5pm Lic. Checked ____ Veh. No. 115 Beg. Mileage ____

Narrative: Worked on RLCR and office
"

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
SC-115
Other
Totals

Day 26 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative:
Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Day 27 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative:
Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other

Employee [illegible] Month [illegible] 19

ay [illegible] Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No [illegible] Beg. Mileage ____

orrative: In Lewistown for [illegible] [illegible] at [illegible]

Activity		Miles	Hours
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	5C-71		12
Other			
Totals			12

ay 29 Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No [illegible] Beg. Mileage ____

arrative: In Lewistown for meeting. Returned to Conrad.

Activity		Miles	Hours
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	5C-71		12
Other			
Totals			12

ay 30 Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No 114 Beg. Mileage ____

arrative: Worked on KCCR in office

Activity		Miles	Hours
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	5C-71		8
Other			
Totals			8

Use back of sheet where more space is needed. Be sure to indicate date!

Employee [illegible] Month Jul. 19 75

ay 31 Time Started [illegible] Time Ended [illegible] Lic. Checked ____ Veh. No [illegible] Beg. Mileage ____

arrative: [illegible] to [illegible]

Worked on KCCR in office

Activity		Miles	Hours
Law Enforcement			
Game Management			
Game Control			
Fisheries Management			
I & E			
Field Services			
F.A. Proj.			
	5C-715		5
Other			3
Totals			8

y ____ Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No ____ Beg. Mileage ____

rrative:

Activity	Miles	Hours
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

y ____ Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No ____ Beg. Mileage ____

rrative:

Activity	Miles	Hours
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		

AP-1.1
4-74

UTAH STATE DIVISION OF WILDLIFE RESOURCES
MONTHLY SUMMARY OF ACTIVITIES

Employee Jeff Grandison Month August 19 75

NON-FEDERAL AID ACTIVITIES:	Miles	Hours
LAW ENFORCEMENT		
Arrests No. 0		
Licenses Checked No.		
Other Law Enforcement Agency Activities:		
GAME MANAGEMENT		0
GAME CONTROL		0
FISHERIES MANAGEMENT		8
INFORMATION AND EDUCATION		0
Other		12

	Number	Adults	Youths
School Programs			
Lectures			
Hunter Safety Classes			
Tours of Installation			
Visitors to Installations			

Press Contacts ______ Releases ______

Radio Station Contacts ______ Programs ______

	Miles	Hours
~~FIELD SERVICES~~ Project 50-115 VTN		129
Total		149

FEDERAL AID PROJECTS	Vehicle No.	Miles	Fed. Aid Days

Annual Leave: No. Days 1, Dates 20

Sick Leave: No. Days 2½, Dates 22, 25, 26

FOR EMPLOYEE COMMENTS AND ADDITIONAL INFORMATION USE OTHER SIDE

Day 1 Time Started 8 30 AM Time Ended 5 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Worked on Regional Wildlife Report

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 2 Time Started 8 AM Time Ended 5 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Worked on Regional Wildlife Report, monthly reports & itineraries.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 3 Time Started 8 AM Time Ended 5 PM Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Worked on regional wildlife reports, phenology data.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19__

Activity Miles Hou

Day 4 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Day 5 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Day 6 Time Started 7 AM Time Ended 5 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Assisted Phil Wagner in osprey survey (key data - exchange for time he spent 8-9 on White River assisting me.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Day 7 Time Started 7 Am Time Ended 5 Pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Checked on deer .06 05, .07. Couldn't find .01 - took soil samples for Dr. Skryja.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 8 Time Started 7:30 Time Ended 5 Pm Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Looked for .01 - couldn't locate. Checked on .06, .07. Divided soil samples for Skryja.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 9 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No ____ Beg. Mileage ____

Narrative: Off

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19__

Activity Miles

Day 10 Time Started 6:30 AM Time Ended 5 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Looked for coyote - bobcat sign on north side of river. Some sign found - probably worth while to trap in Sept. Pulled trailer in from Massey Jct.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 11 Time Started 7:30 AM Time Ended 7 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Looked for coyote sign in Hell Hole - very little. Helped stock White River. Checked on deer .02 at S-11.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Day 12 Time Started 8 AM Time Ended 5 PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Checked for deer at Southam, S-4, K-2, Preacher Canyon. None in evidence.

Law Enforcement
Game Management
Game Control
Fisheries Management
I & E
Field Services
F.A. Proj.
50-115
Other
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Activity Miles Hou

Day 13 Time Started 8AM Time Ended 5PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Regional Meeting in [illegible]

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 14 Time Started 8AM Time Ended 6PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Assisted in shocking on White River – rained out in P.M.

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		9

Day 15 Time Started 8:30 AM Time Ended 7PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Gave program to legislators at White River.

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19 ____

Day 16 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 17 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 18 Time Started 7:30 AM Time Ended 5PM Lic. Checked ____ Veh. No 1145 Beg. Mileage ____

Narrative: Plant phenology studies and soil moisture studies.

Activity	Miles	Hou
Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Day 19 Time Started 8AM Time Ended 5PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Worked on plant phenology studies and soil moisture studies. Worked on reported oil leak from capped well.

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
56-11-5
Other ____
Totals

Day 20 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Annual Leave

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Day 21 Time Started 7AM Time Ended 4PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Went to White River with Crosby to look for oil leak - found it in Cowboy Canyon.

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19__

Activity Miles Hours

Day 22 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Sick Leave

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Day 23 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Day 24 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement ____
Game Management ____
Game Control ____
Fisheries Management ____
I & E ____
Field Services ____
F.A. Proj. ____
Other ____
Totals

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19 ____ | Activity | Miles | Hours

Day 25 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Sick Leave

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
Other		
Totals		

Day 26 Time Started 9Am Time Ended 1PM Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Took soil samples to Durango

½ day sick leave

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 27 Time Started 6:30 Am Time Ended 6PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Attended OSEAP meeting in Rangely

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

Employee ____ Month ____ 19 ____ | Activity | Miles | Hours

Day 28 Time Started 8:30 Am Time Ended 5PM Lic. Checked ____ Veh. No. 1145 Beg. Mileage ____

Narrative: Worked on monthly reports and fin. Discussed OSEAP meeting with Clair, also format of annual & final reports for project

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 29 Time Started 7AM Time Ended 5PM Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Initiated plant phenology studies + soil moisture studies.

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Day 30 Time Started ____ Time Ended ____ Lic. Checked ____ Veh. No. ____ Beg. Mileage ____

Narrative: Off

Law Enforcement		
Game Management		
Game Control		
Fisheries Management		
I & E		
Field Services		
F.A. Proj.		
50-115		
Other		
Totals		

Use back of sheet where more space is needed. Be sure to indicate date!

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
7/1/75	1/8 mile downstream from mouth of Hell Hole Canyon. Riparion	Ocular	2 does	No fawns following.
	1/8 mile above Evac. pipeline crossing on White River. Riparion	Ocular	2 does; 1 buck	No fawns following.
7/11	One half mile due east of S-4 Shadscale-sagebrush	Ocular	1 doe	No fawns.
7/16	Across river from old cabin 1/4 mile below X-2. Riparion	Ocular	2 does; 1 buck	No fawns following.
7/21	One-half mile due north of A-10. Sagebrush-shadscale	Ocular	2 bucks	No collars.

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
7/8/75	One mile north of S-12. Sagebrush-shadscale	Ocular and Radio	.09 alone	No fawns seen.
	Midway between S-4 and X-2 on north side of river. Riparion	Radio	.07	
	Across river from X-2 Riparion	Radio	.02	
	One half mile upstream from S-4. Riparion	Radio	.01	
	Under Evac. pipeline crossing on White River. Riparion	Radio	.06	
	Mouth of Cowboy Canyon on south side of river. Riparion	Radio	.05	
7/4	1/4 mile above Evac. pipeline crossing on White River. Riparion	Radio and Ocular	.06	Two fawns following.

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
7/9	One mile northeast of S-12. Riparion	Radio	.09	
	One half mile due west from X-2 on north side of river. Riparion	Radio	.02	
	One half mile northeast of S-4 on north side of river Riparion	Radio	.07	
7/11	One half mile downstream from S-5 Riparion	Radio	.06	
	One fourth mile below mouth of Cowboy Canyon on south side of river Riparion	Radio	.05	

DATE	LOCATION AND VEGETATION TYPE	SIGHTING TYPE	NUMBER & CLASSIFICATION	COMMENTS
8/7	One-fourth mile downstream from S-5 on south side of river. Riparion	Radio	.06	Couldn't see fawns or doe.
	Mouth of Cowboy Canyon on south side of river. Riparion	Radio	.05	Couldn't find with glasses.
8/8	One mile due west of X-2 on N. side of river. Riparion	Radio	.02	
8/11	One mile NW of S-11 on west side of river Riparion	Radio	.09	
8/10	One-half mile due north of A-7. Sagebrush shadscale	Ocular	2 does - 1 buck	
	Midway between S-4 and X-2 on north side of river. Riparion	Radio	.07	

V. GEOLOGY AND SOILS

GEOLOGY AND SOILS: NO DATA THIS QUARTER

VI. HISTORIC AND SCIENTIFIC INVESTIGATIONS

A. INVENTORY AND EVALUATION OF CULTURAL RESOURCES

THE FOLLOWING SITE LOCATION DATA AND MAPS ARE TO BE OMITTED FROM PUBLIC COPIES OF THE U-A AND U-B ANTIQUITIES REPORTS TO PREVENT UNAUTHORIZED COLLECTING AND VANDALISM.

"An Inventory and Evaluation of Cultural Resources in and Around Oil-Shale Lease Areas U-a and U-b."

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Appendix II	Completed Site Survey Forms with Attached Photographs (and topographic maps)	
Appendix III	Short History of the Uinta Basin, Utah (map, pg. 30 of text)	

AN INVENTORY AND EVALUATION OF CULTURAL RESOURCES IN AND AROUND OIL-SHALE LEASE AREAS U-a AND U-b

Final Report

by

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and
Claudia F. Berry

with illustrations by
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Prepared under the Direction of

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July 30, 1975

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FORWARD

The format and organization of the following report necessitate some comment. The VTN Corporation has requested specific types of information not usually included in professional archeological reports. Inclusion of these data in the main body of the text would have disrupted the format and distracted from the flow and general readability of the descriptive and interpretive sections of the report. Thus, information not directly relevant to the prehistory of the oil-shale tracts appears in appendix form at the end of the basic text. This includes a compilation of site survey forms, vitae of those responsible for the study, a list of relevant federal and state archeological legislation, and an annotated bibliography of archeological references specific to the Uinta Basin. The section prepared by Floyd A. O'Neil and Gregory C. Thompson on the history of the region also appears in appendix form (Appendix III).

No discussion of the geologic and biotic setting has been included in this report. Extensive studies of this nature are currently being prepared as part of VTN's Environmental Baseline Monitoring Program. Additional alterations in the normal format of an archeological survey report are the result of research orientation. As noted in the discussion of objectives and methods, this study was essentially an inventory. As such, the sequence of topics normally discussed in the context of problem oriented surveys, i.e., problem-analysis-results-and-conclusions, would be inappropriate. We simply wished to determine what cultural phenomena were in the area, what these phenomena represented, and their significance.

As noted in Conclusions and Recommendations the archeological resources of the lease lands have already been subjected to intensive surface

collection and illicit excavation. Uncontrolled distribution of this report could lead to further vandalism since site locations are shown in Figure 4 and Appendix II. I therefore request that VIN delete site locale data from copies of this report except those distributed to professionally recognized archeological agencies and institutions.

With the permission of VIN, I plan to publish a modified version of this report in the Antiquities Section Selected Papers. Consistent with the palliative measures suggested above, specific locational data will not be included. This information will remain on file at the Antiquities Section and will, of course, be made available to interested professionals.

David B. Madsen
State Archeologist
July 31, 1975

SYNOPSIS

Between July 15, 1974 and May 27, 1975, the Antiquities Section, Division of State History under contract with VTN Colorado, Inc. conducted an archeological and historical inventory of Utah oil-shale tracts U-a and U-b near Bonanza, Utah. As a result of that and limited work by previous investigators, 31 archeological and six historical sites have been recorded on and adjacent to the lease lands.

The archeological sites consist of rockshelters, open encampments and one isolated rock art panel. The designation of cultural affiliation is, in most cases, an open question owing to the lack of coherent syntheses of the prehistory of the Uinta Basin. Archaic occupance can be unequivocally demonstrated at only one site (42Un377) on the basis of diagnostic projectile point types. A local amateur recovered 123 lithic implements from this site, ranging from McKean points (ca. 5500 to 3500 B.P.) to late prehistoric types (1500 to 750 B.P.). Cultural remains from other sites may tentatively be ascribed Northwest Plains, Uncompahgre and Basketmaker II affiliations. No evidence of Paleo-Indian or Fremont occupance was recovered at any of the sites.

Virtually all of the rockshelters have been vandalized and most of the open sites have been intensively surface collected. We recommend test excavation of all sites followed by complete excavation of the most productive sites. We also recommend an extensive program of survey and site monitoring of areas within a 50 mile radius of the tracts in order to evaluate the social impact of economic development.

With the exception of the Ignacio Stage Stop, the historic sites are of little significance. They consist of small log dwellings and corrals associated with the livestock and gilsonite industries of the area. Reconstruction and protective measures are deemed inappropriate. The Ignacio Stage Stop has been nominated for National Register status by the Bureau of Land Management.

Funding of research, excavation and monitoring programs should be made available prior to tract development. In addition to the anticipated social impact of the project, the proposed construction of the White River Reservoir by the Department of Water Resources, State of Utah, poses a direct threat to numerous sites. Two sites will be destroyed by dam construction and another 12 will be inundated when the pool level of 5010 ft. is attained.

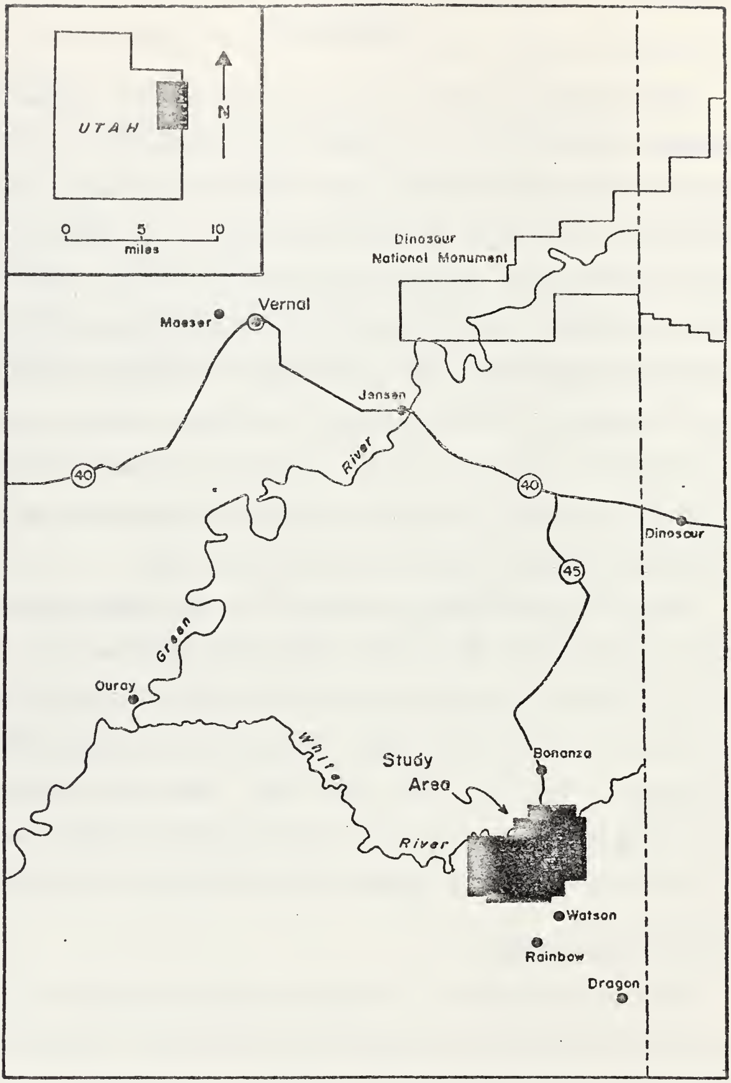
INTRODUCTION

During fiscal year 1974-1975 the Sun-Phillips-Sohio Company, through its agent, VTN Colorado, Inc., sponsored an archeological and historical resources inventory of oil-shale lease areas U-a, U-b, and a surrounding one mile wide buffer zone in Uintah County, Utah. The inventory was conducted by personnel of the Utah State Historical Society, under the direction of Dr. Melvin T. Smith (Director, Utah State Historical Society) and Dr. David B. Madsen (Utah State Archeologist). Inventory operations were done in cooperation with the Department of Interior, Bureau of Land Management, under the auspices of Federal Antiquities Act Permit #74-UT-052. Data and artifacts collected during the inventory are permanently on file at the Utah Museum of Natural History, Salt Lake City, Utah.

The area of investigation consists of ca. 42.5 square miles in Sections E½ 13, E½ 24, E½ 25, E½ 36, T10S, R23E; Sections 1, 2, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, T10S, R24E; Sections 8, 17, 20, 29, T10S, R25E; and Sections N½ 1, N½ 2, N½ 3, N½ 4, T11S, R24E. This area is located just south of the White River and west of the Utah-Colorado border, approximately 40 miles south-southwest of Vernal, Utah (see Figure 1 for location).

OBJECTIVES AND METHODS

The primary objective of a cultural resource inventory is to locate any and all archeological and historical sites within a bounded area. Interpretation of the data within the context of archeological and historical research goals is relegated to a secondary, or peripheral, objective. The cultural inventory is an outgrowth of legislation that requires professional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Ouray
40
Dinosaur
45
White
River
Study Area
Bonanza
Watson
Rainbow
Dragon

Figure 1. Location of Study Area

investigation and evaluation of the potential impact of economic development within a specific geographic domain. An inventory is thus distinct from a survey, which does not recognize arbitrary modern economic or political boundaries as significant factors. The objective of a survey is dependent upon specific research interests, hypotheses and assumptions. A survey is designed to assess the validity of culture sequences and/or theories of culture process and is seldom complete or exhaustive within a specific area.

The methods appropriate to the realization of the disparate goals of an inventory and a survey are, likewise, distinct. A survey incorporates such procedures as predictive models and stratified random samples designed to extract the maximum amount of information in the least amount of time. Explicitly formulated hypotheses permeate the conduct of a survey from general considerations of which ecozones will be sampled to the specific definition of what constitutes a site and how individual sites will be sampled. An inventory, as the word implies, necessitates total documentation of archeological and historic remains in areas of potential impact. In an inventory the "sample" is presumably equivalent to the totality of remains and predictive models and statistical sampling techniques are irrelevant. An area is not sampled; every square foot must be investigated and remains that might not qualify as a site in a survey context must be recorded since the criteria of what constitutes a "site" are evolved pragmatically in the field rather than a priori within the context of a problem oriented research design.

The inventory is a relatively recent phenomenon stemming from legislative action (see Appendix IV) which was designed to temper the onslaught of economic development by implementing measures to preserve and protect cultural resources. This legislation comes as a mixed blessing to archeologists and historians alike. On the positive side, the funds available for fieldwork in the cultural sciences have been markedly increased and areas that might not have been investigated under the traditional funding procedures have been subjected to professional scrutiny. On the negative side, it has led to an inefficient ratio of data recovered to funds committed. The development of "inventories" is antithetical to the concept of survey as it has evolved through the years in the cultural sciences. On a general level, survey means investigation *and* sequential reinvestigations in the context of an ever-changing, ever-expanding, level of scientific understanding and questioning. This is analogous to the long-standing excavation practice of removing only a portion of the deposits on the assumption that future investigators will have more refined or wholly different questions to ask of the site. The inventory and associated "salvage" excavation are inherently at odds with the whole concept of reassessment. *All* the data must be extracted in one process. This is, of course, an unrealistic objective which can never be attained.

The Antiquities Section investigation of the Uinta Basin oil-shale lands was, of necessity, an inventory. As such, it was an extremely inefficient operation. As shown in Figure 4, 90 percent of the sites are located on the banks of the White River or along its intermittant tributaries. This is a wholly expectable distribution and a simple predictive model could have been used to adequately sample the area in a two-week period. However, for the reasons given above, it was necessary to expend 211 man-days to ensure *total* coverage of the tract lands and the one-mile buffer zone.

FIELD TECHNIQUES AND RESULTS

Three archeological sites were previously recorded within the buffer zone boundary. The Antiquities Section redefined one of the two known archeological sites and discovered an additional 30. Representatives of the Department of History, University of Utah documented five historic sites.

Standard recording techniques were employed in the field. Sites were located as nearly as possible on U.S.G.S. 7.5 minute maps and described to include, area of cultural debris, depth and character of fill, surrounding terrain, local vegetation, etc. Sites were photographed and potentially diagnostic artifacts were sketched to scale and filed with the survey forms. Surface collections included all finished artifacts and a representative sample of associated lithic debris. No attempt was made to record intra-site distributional variation. Surface debris has been shuffled and re-shuffled by local collectors to such an extent that the present distribution is hopelessly skewed. Site collections were temporarily stored in paper bags appropriately marked with provenience data, type of material, and date of collection.

Sites were located in the field simply by walking the ground. A field crew of four to five trained individuals criss-crossed the survey area at intervals of 20 to 100 ft., with intervals dependent on surface morphology, ground cover, etc. Actual field work was conducted during four periods--July 15 to September 25, 1974; October 16 to October 28, 1974; November 25 to December 23, 1974; and May 17 to May 27, 1975. Completion of field work was delayed due to inclement weather conditions. The following individuals were involved in various aspects of field and analysis work: Jan Applegarth, John Autrey, Claudia Berry, Michael Berry, Stanley Davis, Laurie George, Dixon Hindley, LaMar Lindsay, Chris Lund, David Madsen, Cherie Pitt, and Thomas Zeidler. Historical sites were initially identified by the archeological survey crew and were checked in the field by Floyd O'Neil and Gregory Thompson of the American West Center, University of Utah.

The results of the investigation and analysis are reported herein. The format is a straightforward presentation of the data to include sections entitled Previous Investigations, Prehistoric Cultures of the Uinta Basin, Archeological Sites of the Oil-Shale Lands, Artifacts, Summary and Discussion, and Recommendations.

PREVIOUS ARCHEOLOGICAL INVESTIGATIONS IN THE UINTA BASIN

The first person to mention the presence of archeological material in the Uinta Basin was Escalante, who, in 1776, described a ruin near the Duchesne River (Bolton 1950:173). However, the region did not attract academic attention until the 1890's when Henry Montgomery (1894), a professor of natural history at the University of Utah, published his observations in eastern Utah including the masonry towers along Nine Mile Canyon. Several years later Fewkes visited numerous archeological sites in Utah and gave an excellent description of the ruins along Hill Creek (Fewkes 1917a, 1917b). His main concern was the "function" of the stone towers he had observed.

With the exception of these few observations, the Uinta Basin was largely ignored by archeologists until the second quarter of the twentieth century. From 1920 until 1947 several areas in the Uinta Basin received the attention of numerous persons interested in the antiquities of the area. All of these explorations were of short duration. The published accounts are brief and primarily descriptive, with little attempt to determine the age or cultural affiliation of the prehistoric occupation. As Julian Steward noted in 1940 (Steward 1940:486-487), "It is particularly unfortunate . . . that cave sites of the Upper Colorado Plateau, which contain a wealth of perishable materials, have been consistently despoiled by pothunters. The only scientific monograph which adequately described such materials is Morss's report on the Fremont River in central Utah (Morss 1931)." The following chronological record of exploration summarizes the results of archeological reconnaissance and excavation in the Basin for this period.

In 1921, L. S. McCandless, with a party of four from Craig, Colorado, explored Castle Park on the Yampa River in Dinosaur National Monument, where he found three caves with structures, pottery and corn. His observations were published in the Steamboat Pilot, February, 1921 (Jeancon 1927). On the basis of McCandless' report, Jean Jeancon, of the Colorado State Historical Society, explored Lizard Canyon in 1924, just south of Yampa Canyon, and reported caves with beehive-shaped storage structures and corn caches (Jeancon 1927). In 1928 and 1929, Noel Morss did limited work in Nine Mile Canyon with the Claflin-Emerson Expedition from the Peabody Museum at Harvard University. This was published in 1931 (Morss 1931) by Morss, who noted that the material from Nine Mile was very much like the material from the Fremont River that he had used to define the Fremont culture. In 1931, the final field season of the Claflin-Emerson Expedition, led by Donald Scott, concentrated efforts along the Green River and its tributaries from Green River, Utah, north to the Uinta Mountains. Selected sites were excavated in Hill and Willow Creeks and in the Uinta Mountain foothills near Myton and along Dry Fork-Ashley and Brush Creeks. Sites were also visited in Florence and Chandler Creeks. Unfortunately, this important material was not published until 1969 (Gunnerson 1969). The large collection of rock art photographs made by Donald Scott were not incorporated in a publication until 1971 (Schaafsma 1971).

During the early 1930's, Albert B. Reagan, then with the United States Indian Field Service at Ouray, Utah, published numerous articles in widely scattered journals on the archeology of northeastern Utah. An effort has been made to include all of these articles in the bibliography, although several are not available for examination. Some of the photographs and material collected by Reagan are on file at the Laboratory of Anthropology in Santa Fe. It is difficult to evaluate Reagan's work, since many of his interpretations are not kept separate from observations. Nevertheless, he did place on record the fact that numerous sites did exist (often in locations not visited since then by any archeologists) along with some information on their location and associated artifacts. Much of the material he described, such as structures and rock art, has been destroyed or mutilated since the 1930's.

In the early 1930's Steward (1933a) conducted brief excavations seven miles north of Ft. Duchesne where he found the remains of rectangular shallow pit dwellings and a rock wall house. Other brief investigations were also conducted in the 1930's by various people. Beckwith (1935) reported petroglyphs near Vernal. Gaumer (1937) reported on excavations at a Basketmaker cave near the Green River, but the exact location of the material is unclear. Leh (1936) made a brief reconnaissance along Range Creek and reported several sites, mainly granaries. More extensive work was done by the University of Utah in 1936 along Nine Mile Canyon (Gillin 1938). Gillin's work is recognized as an important contribution to Uinta Basin and Southwestern archeology. The tree-ring specimens collected during this expedition were of special importance for placing archeological material from northeastern Utah in a temporal context. The beams from Nine Mile provided the key link in setting up the sequence from archeological to living trees (Schulman 1948, 1951; Ferguson 1949).

Other work in the 1930's centered in Dinosaur National Monument. A party representing the Colorado Biological Survey explored Castle Park in 1933, under the leadership of F. Martin Brown. An account of their observations was published in a brief but well-illustrated descriptive article (Brown 1937). In 1936, a party representing the Colorado Mountain Club explored the Yampa Canyon (Morris et al. 1937). In 1940, Charles Scoggin and Edison Lohr conducted excavations and survey in Castle Park, concentrating on

Mantle's Cave (Lohr 1948). During 1941, under a temporary appointment as a park ranger, Scoggin continued archeological reconnaissance in Dinosaur National Monument outside Castle Park. In 1942, a survey party of the National Park Service investigated proposed reservoir areas along the Yampa and Green Rivers. They found 33 sites, and a brief report of their work was published in 1947 (Baldwin 1947).

In 1941, Elmer R. Smith and a party from the University of Utah undertook an archeological survey in northeastern Utah and northwestern Colorado intended to be the basis for a larger program of research in eastern Utah. The party covered the area from the southern boundary of Dinosaur National Monument to the Roan Cliffs, and from the confluence of the White River and Bitter Creek in Utah, to the easternmost part of Douglas Creek in Colorado. The only information concerning these investigations is contained in a few sketchy notes from the excavation of Dripping Rocks Cave. Anderson used these notes to publish a less than illuminating site report (Anderson 1964).

The late 1940's saw a continued effort to understand the archeology and natural history of Dinosaur National Monument by the University of Colorado Museum with the cooperation of the National Park Service. The results of the archeological studies made in the area through October, 1947, were published in 1948 (Burgh and Scoggin 1948). This major work on the prehistory of northeastern Utah was mainly concerned with investigations in Castle Park, and more particularly with the excavation of Mantle's Cave, visited by so many previous investigators. Another site in Castle Park, Marigold's Cave, was excavated in 1948 and 1949 by Herbert Dick (Dick n.d.). A pinyon pine beam from this cave dated the Fremont occupation to ca. 1200 B.P. and represents the farthest north extension of the Southwestern ring chronology (Schulman 1950; Burgh 1950). Other excavations by the University of Colorado

Museum included work at a stratified open site, Hells Midden, where an agricultural Fremont component was found overlying pre-pottery deposits (Lister 1951). Other manuscripts concerning work in Dinosaur National Monument during the 1940's have been included in the bibliography even though they were not available for examination (Scoggin 1941; Dick 1949, 1950; Stirland 1947; MacLeod 1959).

Little archeological work was done in the Uinta Basin during the 1950's when compared with the previous ten-year period. One survey was conducted by Gilbert Wenger, a student from the University of Denver, in the Blue Mountain - Douglas Creek area of Colorado, immediately east of the Utah state line. Wenger recorded numerous masonry granaries along the southern slopes of the Blue Mountains (Wenger 1955, 1956). In 1951, the University of Utah began a five-year archeological reconnaissance of the least known sections of Utah. One of the reports which resulted from this work was concerned with Eastern Utah (Gunnerson 1957a). Gunnerson's report includes sites recorded along the Uinta Mountain foothills, White River, East High Tavaputs Plateau, Hill, Willow, and Florence Creeks, Nine Mile Canyon, and Range Creek Canyon. Many of these sites had been located previously (see various authors, above), but most of that work had not been published.

In March, 1950 a spectacular find was accidently made in Range Creek by Clarence Pillings of Price, Utah. He discovered eleven clay figurines, which by reason of their size, elaborate decoration, good condition and the fact that they had come from a single cache, constituted a significant addition to the corpus of figurines from Utah. Morss (1954) made them the center of his work, Clay Figurines of the American Southwest.

During the 1960's numerous archeological investigations were undertaken in the Uinta Basin, almost all of which were sponsored by two institutions, the University of Colorado and the University of Utah. The University of Colorado began a three-year archeological project in Dinosaur National Monument in 1963, under contract to the National Park Service, to survey and compile an Archaeological Base Map for the Monument. Excavations were also undertaken at selected sites. The survey located 413 sites, only 16 of which could definitely be classified as Fremont by the presence of diagnostic pottery. The majority of sites were considered to be "basically aligned with the Desert Culture" (Breternitz 1965). A few were identified as Ute. Twenty-four sites were excavated. The report on excavations at 22 of the sites was published in 1970 (Breternitz 1970). The excavation of the other two sites, Deluge Shelter and Boundary Village, were published separately (Leach 1966b, 1970). This work provided important data for the interpretation of Uinta Basin prehistory. Unfortunately, the majority of this material was undated. Deluge Shelter, a deep stratified site with Fremont, Archaic and, perhaps, Basketmaker levels, is one of the most important dated sites in the Basin with an early date of ca. 3800 B.P.

In 1964, excavations were conducted by a University of Colorado student, J. R. Ambler, at Caldwell Village, a large Fremont village on Deep Creek near LaPoint, Utah. The site is located approximately four miles northeast of the sites excavated by Steward in the 1930's (Steward 1933b:32-34). The resulting data were the basis for Ambler's dissertation and were published in 1966 (Ambler 1966a, 1966b). At least 22 pithouses were recorded, as well as a large quantity and variety of artifacts which added considerably to the corpus of data on the Uinta Fremont.

The University of Utah's work in the Uinta Basin was limited to the excavation of five Fremont village sites. Whiterocks Village provided one of the largest ceramic collections from the Uinta Basin. The report (Shields 1967) describing this work included no synthesis of Uinta Basin prehistory. However, this work did furnish some of the few radiocarbon dates for the Uinta Fremont, ranging from 1280 to 1090 B.P. Kent Day (1964) also conducted excavations at Thorne Cave, a stratified site near the Green River. This site yielded the earliest dated Archaic component (ca. 4200 B.P.) in the Uinta Basin, but provided few diagnostic artifacts.

The most recent published work in the Uinta Basin was done by Polly Schaafsma who visited and photographed many of the well-known rock art panels in the Ashley-Dry Fork area and Dinosaur National Monument (Schaafsma n.d., 1971). Her synthesis of rock art in Utah has a large section on the distinctive motifs found in the Uinta Basin and incorporates much unpublished earlier work as well.

During the twentieth century, the Uinta Basin probably received more attention from archeologists than any other region of the state, with the possible exception of the Anasazi area. Despite this, no work has appeared which provides a synthesis of the prehistory of the area. To date, no attempt has been made to order this vast amount of archeological data.

Previous Research on Tracts U-a and U-b

Very little archeological investigation had been conducted within the Utah oil-shale lease lands prior to the Antiquities Section inventory. James Gunnerson of the University of Utah recorded two sites (42Un106 and 42Un118) in 1954. Richard Fike of the Bureau of Land Management revisited 42Un118 and recorded 42Un324 in 1972. In a 1974 preliminary survey of the lease lands, Gardiner F. Dalley of the University of Utah revisited 42Un118 and (probably) 42Un106.

PREHISTORIC CULTURES OF THE UINTA BASIN

Portions of the Uinta Basin have been occupied by Archaic hunter-gatherers, Fremont agriculturalists, and the proto-historic and historic Ute. In addition to these well documented cultures there is evidence of varying quantity and quality for the presence of Paleo-Indian "Big-Game" hunters, Basketmaker II groups, and late prehistoric Northwest Plains hunter-gatherers.

Despite extensive survey and excavation activities in the Uinta Basin, our knowledge of spatio-temporal relationships and prehistoric subsistence/settlement patterns is extremely sketchy. A large percentage of the work was done prior to 1950, and thus, before the development of radiocarbon dating. More recent work in the Basin also suffers from a paucity of radiocarbon dates. Deficiencies in the extant data and the major interpretive difficulties involved are discussed below.

PALEO-INDIAN (Fig. 2)

The evidence for Paleo-Indian occupance of the Uinta Basin is limited to a Folsom point found near Duchesne (Crouse 1954) and a Folsom mid-section from Roosevelt, Utah. This is somewhat surprising since Folsom sites are reported within reasonable proximity of the Basin to the north, east and south: the Finley site (Howard 1942) in west-central Wyoming; Hell Gap (Irwin 1971) in east-central Wyoming; Lindenmeier (Roberts 1935, 1936) in north-central Colorado; Grand Junction, Colorado (Steward 1933a); the Uncompahgre Plateau (Huscher 1939); Montrose County, Colorado (Wormington 1957); the divide between the Green and Colorado Rivers in southeastern Utah (Hunt and Tanner 1960); and the Silverhorn Site (Gunnerson 1956) in

Figure 2

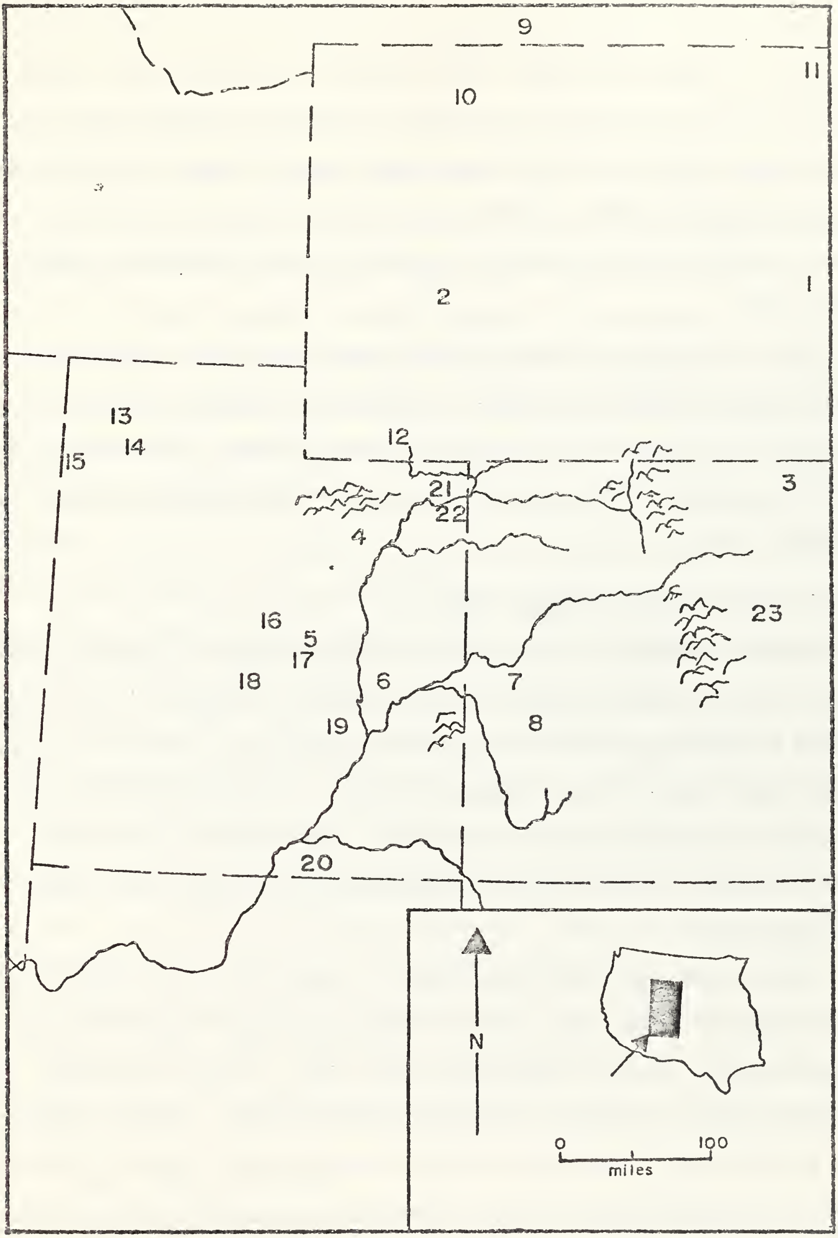
Folsom and Dated Archaic Sites Discussed in Text.

FOLSOM SITES

1- Hell Gap
2- The Finley Site
3- Lindenmeier
4- Duchesne
5- The Silverhorn Site
6- Hunt's Early Man Sites
7- Grand Junction Area
8- Uncompahgre Region

DATED ARCHAIC COMPONENTS

9- Bighorn Canyon
10- Mummy Cave
11- McKean Site
12- Pine Springs Site
13- Hogup Cave
14- Sandwich Shelter
15- Danger Cave
16- Joe's Valley Alcove
17- Clyde's Cavern
18- Sudden Shelter
19- Cowboy Cave
20- Sand Dune Cave
21- Deluge Shelter
22- Thorne Cave
23- LoDaisKa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east-central Utah. The Folsom Complex on the Great Plains has been dated to between 10,780±135 and 9880±350 B.P. (Irwin 1971; Haynes 1971). These distinctive points have also been found in considerable numbers associated with Holocene beaches of the western pluvial lakes of Nevada and California (Davis and Shutler 1969). The Borax Lake finds in California have been dated to 9000 B.P. on the basis of obsidian hydration (Meighan and Haynes 1968, 1970).

The near absence of reported Folsom finds in the Uinta Basin may be attributable to geologic processes, as suggested by Jennings (1968), e.g., the majority of sites may be buried by Holocene alluvium. Obviously, we must rely on future work to demonstrate or refute the presence of Folsom big-game hunters.

ARCHAIC PERIOD HUNTER-GATHERERS (Fig. 2)

The term "Archaic" is used here as a relative temporal designator referring to the time span encompassed by the inception and demise of the earliest hunting and gathering cultures in western North America. The terms "Desert Archaic" and "Desert Culture" (Jennings various) are not employed here since the adaptive implications and the associated interpretive framework are inconsistent with current models of paleoenvironmental conditions (Madsen and Berry 1975).

Temporal placement varies from region to region as do the specific artifact complexes. The Archaic period in Utah began at ca. 10,000 B.P. and lasted until ca. 2500 B.P. (Madsen and Berry 1975). Initial settlement occurred along the periphery of Holocene Great Salt Lake. Faunal remains from lakeside sites such as Danger Cave (Jennings 1957), Hogup Cave (Aikens 1970), and Sandwich Shelter (Marwitt, Fry and Adovasio 1971) included mule-deer, bison, antelope and several species of rodents and avifauna. Edible plant remains consisted primarily of marsh and halophytic[1] species dominated by pickleweed (*Allenrolphia occidentalis*). Associated artifacts included the atlatl[2] (employing both lanceolate and notched, triangular points), flat slab milling stones, basketry, rabbit nets, rabbit skin robes, stone drills and scrapers, bone awls and a wide variety of other utilitarian implements. Lakeside settlement pattern was closely tied to lake level oscillations. Floral and faunal resources were most abundant in the context of a stable or receding level. The latter situation resulted in the exposure of fresh water springs and, consequently, an increase in the area of lake periphery marshes. Marsh flora were used directly as resources and also attracted an abundance of mammals and game birds. Gradual lake recession also created playas suitable for halophytes. Increases in lake level inundated springs and marshes and reduced halophyte availability. Numerous periods of high lake levels during the Holocene (Madsen and Berry 1975; Currey and Madsen 1974) forced lacustrine adapted populations of the Great Basin to migrate to more productive environments in Idaho, Wyoming, and the Colorado Plateau of eastern Utah and western Colorado. The extreme recession of the lake between 5500 and 3500 B.P. probably reduced the lakeside carrying capacity as effectively as the previous inundations and, likewise, resulted in the emigration of at least a portion of the Archaic population. These periodic movements are attested to by the numerous, culturally sterile spall layers in the deep deposits of Danger Cave (a lake periphery site) which correspond temporally with the basal dates of sites north and east of the Great Basin. The final period of Archaic lacustrine adaptation in the eastern Great Basin came to a close at ca. 3500 B.P. in response to the high lake levels of the Neoglacial.[3] Archaic occupation of upland regions of the Basin ceased by 2500 B.P. (Fowler, Madsen and Hattori 1973; Madsen and Berry 1975) and the entire eastern Great Basin remained unoccupied until the influx of Fremont agriculturalists at ca. 1250 B.P.

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[1] salt tolerant species

[2] a throwing board used to propel a long dart tipped with a stone point

Archaic occupation of the Colorado Plateau in general and the Uinta Basin in particular is best understood in relationship to eastern Great Basin resource variability. The two earliest dated sites on the Colorado Plateau are Joe's Valley Alcove (ca. 8000 B.P.; Evan DeBloois personal communication) and Sudden Shelter (7500 B.P.; Jesse D. Jennings personal communication). Both of these sites are located in central Utah on the fringe of the Plateau. The basal dates correspond with an early Holocene lake maxima. The earliest dated Archaic components in the Uinta Basin are Thorne Cave (Day 1964) and Deluge Shelter (Leach 1970). Both sites contain Great Basin and Great Basin derived (McKean) projectile point types dated at 4200 and 3800 B.P. respectively. These dates fall within the Holocene lake level minima (5500 to 3500 B.P.) when lacustrine resource abundance was probably quite low. Similar lithic assemblages north and east of the Uinta Basin have also been dated to this period: 3600 B.P. at the Pine Springs site in southwestern Wyoming (Sharrock 1966a); 4900 to 3800 B.P. in the Bighorn Basin of Wyoming (Husted 1969); 4400 B.P. at Mummy Cave in northwestern Wyoming (Wedel, Husted and Moss 1968); (prior to) 3300 B.P. at the McKean site in northeastern Wyoming (Mulloy 1954); 4500 to 4200 B.P. at Signal Butte in northwestern Nebraska (Strong 1935; Olson and Broecker

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[3] A relatively brief glacial advance beginning at ca. 3500 B.P. associated with a moist climatic regime.

1959); and 4800 to 3400 B.P. at LoDaisKa in north-central Colorado (Irwin and Irwin 1959).

The data from Thorne Cave sets the basal Archaic occupation date for the Uinta Basin, however, the temporal span of the site was apparently brief since the radiocarbon dates that bracketed the deposits were separated by less than 100 years. A lengthier sequence is indicated for Deluge Shelter. This site contained 15 distinguishable strata separated one from another by either sterile areas or erosional disconformities. The basal stratum (15) yielded very little cultural material and is undated. Leach tentatively identifies the projectile points as Scotsbluff and Dalton but these designations are highly questionable. Leach infers considerable antiquity for stratum 15 because it is sealed by a layer of tufa.[4] This is not necessarily the case, however, since the cultural materials are too scant to definitely tie this component to the Plano complex. Until radiocarbon dates become available, the age and cultural affiliation of stratum 15 must remain an open question. It is possible that the unit relates to Archaic occupation somewhat earlier than the overlying materials. Strata 13 and 14 also yielded sparse cultural materials. Strata 12 through 8 comprise the Archaic component of the site. The three radiocarbon samples from this component are 3630±85 B.P. (stratum 12), 3840±210 B.P. (stratum 11), and 3260±120 B.P. (stratum 8). The Archaic component is capped by stratum 7, a culturally sterile unit which probably indicates a significant occupational hiatus. Leach identifies succeeding layers 6 and 5 as Archaic and 4 and 3 as Fremont. The Fremont assignation is probably correct. Strata 4 and 3 date to 1215±85 and 1030±85 B.P., respectively, and contain Fremont pottery as well as evidence of bow and arrow technology. Leach's identification of levels 6 and 5 as Archaic is probably in error. An alternate interpretation is offered below (see Discussion).

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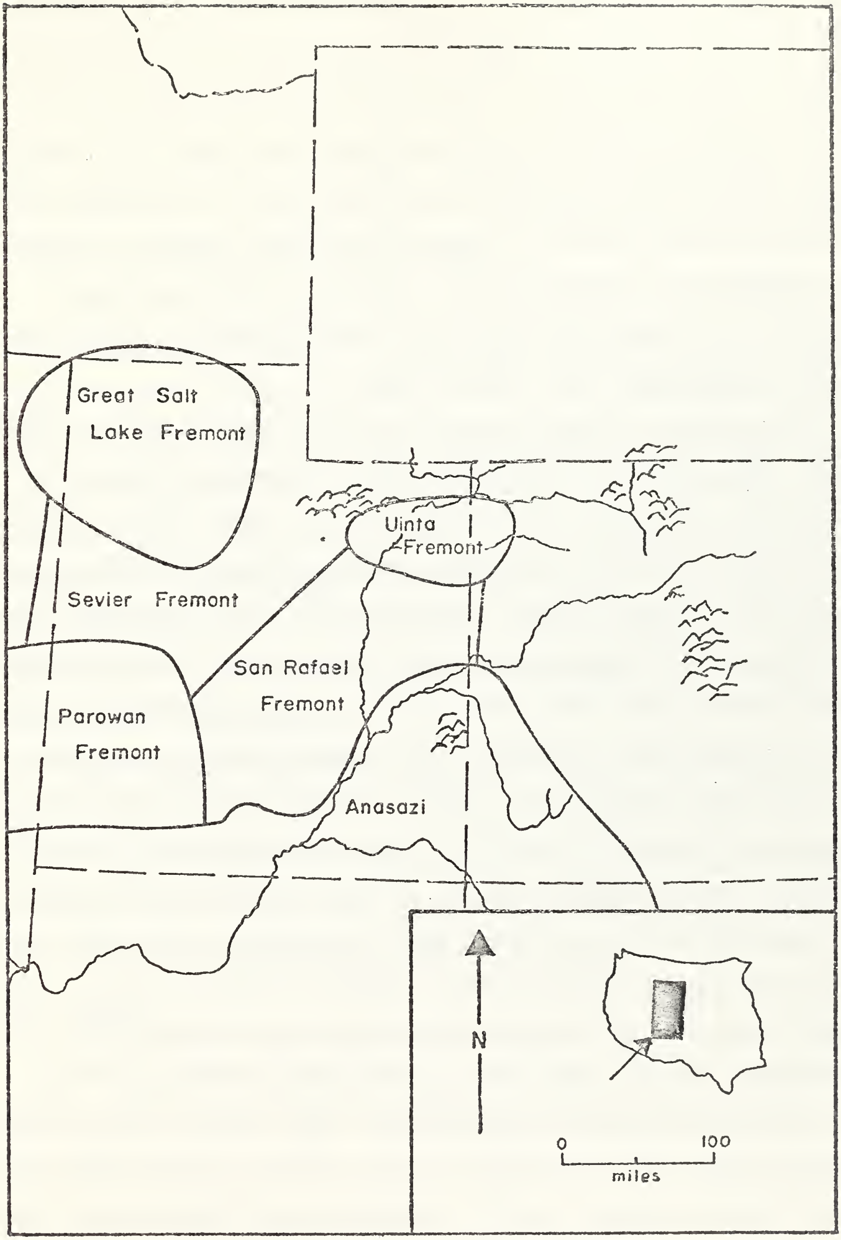
[4] A porous calcareous precipitate deposited by springs, streams and lakes.

The ca. 3300 B.P. date from stratum 8 may well represent the terminal Archaic occupance of the Uinta Basin and possibly the entire Colorado Plateau. The sterile overlying stratum lends credence to this interpretation as does the 3300 B.P. terminal Archaic date from Sudden Shelter (Jesse D. Jennings personal communication), and the 3000 B.P. date from Clyde's Cavern (Winter and Wylie 1974). Other dated Archaic components from the Plateau are considerably earlier: 8000 to 6000 B.P. at Joe's Valley Alcove (Evan DeBloois personal communication), and 7700 to 7150 B.P. at Sand Dune Cave (Lindsay, Ambler, Stein and Hobler 1968). In sum, the admittedly scant data suggest that the Colorado Plateau Archaic period lasted from 8000 to 3000 B.P. and that the Uinta Basin was occupied during the latter portion of this period between 4200 and 3300 B.P. At present, there are no other dated Archaic sequences in the Uinta Basin. Hells Midden (Lister 1951) was excavated prior to the development of radiocarbon dating techniques. Deerlodge Midden, 5Mf132, Swelter Shelter, Serviceberry Shelter and Lowell Spring (all in Breternitz 1970) were excavated by the University of Colorado in the late 1960's. All of these sites contain components identifiable as Archaic on typological grounds. Inexplicably, none of these components was ever dated.

FREMONT AGRICULTURALISTS (Fig. 3)

Aboriginal farming groups in Utah, north of the Anasazi area, are referred to collectively as the Fremont culture. Marwitt (1970) has defined five variants: the San Rafael and Uinta variants of the Colorado Plateau and the Great Salt Lake, Sevier and Parowan variants of the eastern Great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Lake Fremont
Uinta
Fremont
Sevier Fremont
San Rafael
Fremont
Parowan
Fremont
Anasazi
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Figure 3. Approximate Distribution of Fremont Variants.

Basin. The earliest dated sites occur on the Colorado Plateau by 1350 B.P. (Marwitt 1970). Fremont settlement of the Great Basin did not occur until 1250 B.P. in the Great Salt Lake region (Madsen and Berry 1975) and 1050 B.P. in the Parowan Valley to the south (Marwitt 1970; Berry 1972, 1974). Fremont occupation of Utah ended by ca. 650 B.P. Thus the temporal span of the Fremont culture essentially paralleled the Anasazi sequence encompassed by Basketmaker III through Pueblo III. However, in terms of the trait criteria of the Pecos Classification, all sites recognized as Fremont fall within the Basketmaker III - Pueblo I range.

Excavated Uinta Fremont village sites include Caldwell Village (Ambler 1966a, 1966b), Boundary Village (Leach 1966b), Whiterocks Village, the Goodrich Site, Felter Hill, Flat Top Butte (all in Shields 1967), Wholeplace Village, Wagon Run, Fremont Playhouse, the MacLeod Site, Burnt House Village, the Dam Site, Cub Creek Village, and the Ford Site (all in Breternitz 1970). In addition, Hell's Midden (Lister 1951), Mantle's Cave (Burgh and Scoggin 1948), Marigold's Cave (Burgh 1950; Dick n.d.), and Deluge Shelter (Leach 1970) contained Fremont components. This impressive number of excavations has unfortunately produced only a handful of radiocarbon determinations and a single tree-ring date. Ten of the 11 radiocarbon dates (one is clearly aberrant) range from 1450 to 850 B.P. The tree-ring date from Marigold's Cave (Burgh 1950) is ca. 1200 B.P. There is considerable disagreement as to the interpretation of these dates. Breternitz (1970) and Ambler (1967) reject the dates on the assumption that the early C-14 determinations reflect the aboriginal practice of using dead trees for firewood. They estimate the Uinta Fremont occupation span as 950 to 750 B.P. based on the presence of late Pueblo II tradeware. Marwitt (1970) accepts the dates and posits a range of 1300 to 1000 B.P. for Uinta Fremont. He notes that none of the supposed Anasazi "trade" sherds were found in controlled stratigraphic context and may post-date Fremont occupation. I think it wise to follow Marwitt and tentatively accept the dates on the grounds of "best evidence." Ambler's and Berternitz's "dead wood" hypothesis is premature given the small sample size. In addition, one of the earliest dates is on a basketry fragment from Mantle's Cave (Marwitt 1970).

Uinta Fremont sites are typically small settlements consisting of one to five shallow pit structures. Freestanding storage granaries are absent. Sites are usually located on knolls, buttes, or hill slopes above flood plains. Calcite tempered Uinta Gray is the predominant (99 percent) pottery type. The village sites have yielded both corner-notched and side-notched projectile points. The corner-notched varieties resemble Late Woodlands (Johnson 1974) and Uncompahgre Complex (Wormington and Lister 1956) points. The side-notched varieties are formally identical to Plains Side-Notched (Kehoe 1966). The latter are stratigraphically superior to the former at Deluge Shelter (Leach 1970).

Uinta Fremont subsistence was apparently based on corn agriculture supplemented by hunting and gathering activities (Marwitt 1970). This is inferred from the charred corn recovered from village sites and the existence of numerous "temporary use" sites in adjacent ecozones. These consist of small open encampments and cave/rockshelter sites.

NUMIC SPEAKERS

The Ute occupied the region south of the Yampa and Green Rivers in historic times (Stewart 1958). The distinctive Paiute-Shoshoni pottery (also associated with the Ute) occurs on the surface of numerous sites but has yet to be recovered in a stratified context. Thus the antiquity of the Ute in the Uinta Basin is unknown.

DISCUSSION

The interpretive potential of the Uinta Basin archeological resources has yet to be realized. The brief outline given above was obviously not an exhaustive survey of the available data but it does serve to point out some major deficiencies in our current state of knowledge. Perhaps most significant was the absence of any statement regarding diachronic relationships between the four sequent cultures discussed. The scant temporal and skewed distributional data allow only a few speculative inferences.

1) A fairly good case can be made for a major hiatus - possibly 6000 years - between the Paleo-Indian and Archaic period occupations of the Uinta Basin. The Folsom complex is dated to between ca. 11,000 to 10,000 B.P. on the Great Plains. There is no evidence of a transition from Folsom to Archaic period complexes in that region and the earliest dated Archaic component in the Uinta Basin is Thorne Cave (ca. 4200 B.P.). The most probable locus of Paleo-Indian/Archaic transition is within the Great Basin. Folsom points commonly occur on ancient beaches of the western pluvial lakes (Davis and Shutler 1969), and the Borax Lake examples have been dated by obsidian hydration at ca. 9,000 B.P. If this estimate eventually proves correct, it indicates a ca. 1,000 year overlap with the earliest Archaic occupations on the shores of Holocene Great Salt Lake. This temporal overlap combined with the common factor of adaptation to lacustrine environments is, at least, suggestive of a cultural continuum. The gross similarities of the Folsom points to the intergradational early Archaic types, e.g., Pinto, Humboldt and Blackrock, lend a minimal degree of credence to this hypothesis.

2) There is no evidence whatsoever of cultural continuity between Archaic and Fremont. The evidence suggests that Archaic populations abandonned the Colorado Plateau by 3000 B.P. and no Fremont occupation has been

dated earlier than 1350 B.P. This interpretation is compatible with that offered by Madsen and Berry (1975) for the eastern Great Basin and suggests that the state of Utah was unoccupied for a 1000 to 2000 year period beginning shortly after the onset of moist Neoglacial conditions (ca. 3500 to 3000 B.P.).

Thus, the data do not allow the derivation of the Fremont culture from an indigenous Archaic base as posited by Jennings (1957), Aikens (1970), Marwitt (1970), Leach (1970), Wormington (1955), or Rudy (1953). A viable alternative explanation of Fremont origins is derivation from a widespread and geographically diversified Basketmaker II level of technology. There is good evidence for a rapid expansion beginning early in the Christian era of aceramic groups possessing the atlatl and maize agriculture. Leach's "Archaic" assignation of strata 5 and 6 at Deluge Shelter could just as easily be interpreted as a Basketmaker II component, especially in light of the 1625±95 B.P. radiocarbon determination. This assemblage immediately underlies the recognizable Fremont component, but is separated from the underlying Archaic (dated at ca. 3300 B.P.) by a sterile deposit. The absence of maize may simply be a function of poor preservation since no maize was recovered from the "agricultural" Fremont component either.

Earlier workers in the Uinta Basin (Burgh and Scoggin 1948; Gaumer 1937; Reagan various; the Claflin-Emerson Expedition, reported in Gunnerson 1969) and in the central Utah-Colorado border area (Hurst 1942, 1943, 1945, 1947) have recognized similarities between artifact complexes from those areas with Basketmaker II remains in the Four Corners region. Hurst's tree-ring dates of 348 to 371 A.D. (ca. 1600 B.P.) from the Basketmaker II component of Tabeguache Cave (Hurst 1957) are in accord with Basketmaker II dates from southwestern Colorado (Morris and Burgh 1954) and southeastern

Utah (Lipe and Matson 1973; Jennings 1966) as well as the stratum 5 date from Deluge Shelter. It should also be noted that the Clyde's Cavern component designated "late Archaic" by Winter and Wylie dates to ca. 1600 B.P. and contains maize, both Fremont and Anasazi basketry, evidence of atlatl technology, and no pottery. This component is separated from the underlying Archaic (dated ca. 3000 B.P.) by a thick, sterile alluvial or colluvial deposit. Clearly, a Basketmaker II ascription is indicated. Here, as at Deluge Shelter, the succeeding level contains unequivocal Fremont remains.

A review of the evidence suggests that by ca. 1600 B.P., groups functioning on a Basketmaker II level of technology were distributed over the Colorado Plateau from the Four Corners area to the Uinta Basin. It is reasonable to posit that the Uinta and San Rafael Fremont as well as the Anasazi cultures developed from this early agricultural substratum. This is admittedly conjectural, but considerably less so than hypotheses that derive the Fremont from an Archaic base.

3) According to lexicostatistic (Lamb 1958; Miller, Tanner and Foley 1969) and archeological data (Madsen 1975; Berry 1972, 1974), the Numic speaking groups are relatively recent arrivals in the eastern Great Basin and Colorado Plateau. They initially dispersed from a southern California homeland and entered the southeastern Great Basin by ca. 1000 B.P. By ca. 650 B.P., they entered the Great Salt Lake region (Madsen 1975). Their arrival on the Colorado Plateau and Uinta Basin is undated. Future archeological work in the Uinta Basin may well compliment the ongoing lexicostatistical analyses of the Numic dispersion. Numic speaking populations were apparently genetically unrelated to the Fremont groups of the eastern Great Basin and Colorado Plateau. They were, however, partially contemporaneous with the Parowan Fremont of southwestern Utah and may have entered

into symbiotic or competitive relationships with these indigenous populations (Berry 1974). Their temporal and/or systemic relationships with the San Rafael and Uinta Fremont variants cannot as yet be posited.

4) Future investigators in the western Uinta Basin will have to consider the possible occupance by Late Woodland and northwestern Plains cultures. The similarities in projectile points recovered from excavated Uinta Fremont sites to point types associated with the northwest Plains hunter-gatherers and the Late Woodland agriculturalists cannot be ignored. Additionally, Breternitz (1970) reports surface finds of Woodland cord-impressed pottery from Dinosaur National Monument. Given the existence of Late Woodland farming communities between the Missouri River and the Colorado Front Range by 1450 B.P. (Johnson 1974), an eastern origin for the Uinta Fremont is just as plausible as the prevailing hypothesis which claims derivation of all traits from the Southwest.

5) Finally, it is necessary to consider the temporal placement and cultural affiliation of the abundant and impressive rock art panels of the western Uinta Basin. Schaafsma (1971), following Morss (1931), Gunnerson 1957a, 1969) and Sharrock (1966b) has uncritically assigned a Fremont affiliation to these features. However, it is apparent that this is only one of several possible alternatives. Since rock art panels are not typically associated in stratigraphic context with diagnostic artifacts, the Uinta Basin examples could just as equitably be assigned a Paleo-Indian, Archaic, Ute, Woodland or Northwest Plains cultural affiliation. "Typical Fremont" rock art supposedly consists of horned anthropomorphs, shield motifs, "ghost" figures, etc., but identical elements appear as far north as Pictograph Cave in Montana (Mulloy 1958) and as far south as White Dog Cave

in northeastern Arizona (Guernsey and Kidder 1921), i.e., in areas where there is no evidence of Fremont occupance. This is not to say that empirical generalizations regarding the cultural affiliation of rock art is an impossibility. Statistical inference based on the association of particular motifs and surface diagnostics over a wide geographic area might be used to build a convincing case. To date, no such study has been undertaken in western North America.

In sum, our understanding of Uinta Basin prehistory is minimal. We can barely piece together conjectural sequences of cultural events, much less place these events in functional or evolutionary perspective. But even at this incipient state of development, the data suggest that future investigation will have relevance to a considerably broader cultural/geographic interpretive framework.

ARCHEOLOGICAL SITES OF THE OIL-SHALE LANDS

Figure 4 shows the site distribution in and adjacent to the lease lands. Thirty were recorded by the Antiquities Section inventory, and two (42Un118, 42Un324) had been previously documented. Site types include rockshelters and open encampments. These are discussed under separate headings below. Locations are given in Figure 4 and are not discussed in the text. The historical sites are described in Appendix III.

ROCKSHELTERS

42Un118: This site was previously reported by the University of Utah and is known locally as Wagon Hound Alcove. It has been badly vandalized, exposing stratified deposits to a depth of ca. 2 meters. Numerous long, continuous lenses of charcoal, ash and fire-reddened soil are visible in profile. Deposits are alluvial and/or colluvial in origin. Chipping debris, burned bone and corn cobs are abundant but no diagnostic artifacts were observed.

42Un324: The Bureau of Land Management recorded this site in 1972 and it was not revisited during the present investigation. It is reportedly a very slight overhang with deep, sandy fill. A projectile point, chipping debris and charcoal were observed but no collection was taken.

42Un355: Small shelter with shallow, aeolian derived sandy fill. There is no evidence of hearths and the ceiling was not smoke-blackened. One unidentifiable point fragment and chipping debris were collected from the surface.

42Un365: This is a large shelter ca. 4 meters high, 30 meters wide (east-west) and 8 meters deep (north-south). It is littered with machinery

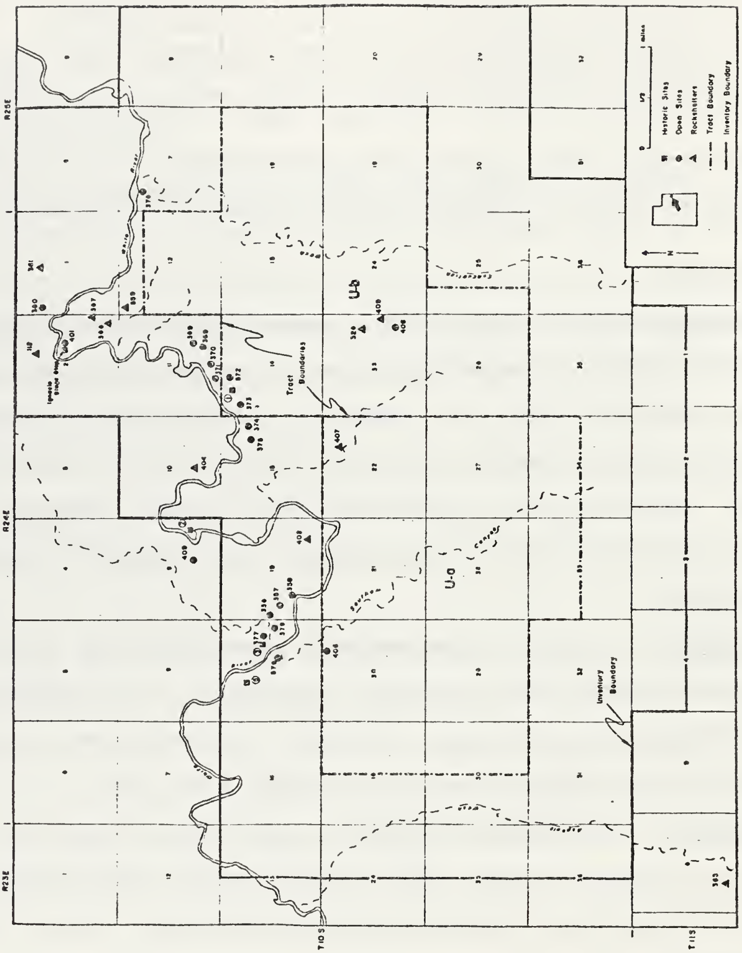
R23E
R24E
R25E
T10S
T11S
U-a
U-b
Tract Boundaries
Inventory Boundary
Historic Sites
Open Sites
Rockshelters
Tract Boundary
Inventory Boundary
0
1/2
1 miles
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Figure 4: Location of Archeological and Historic Sites in, and Adjacent to Tract Areas.

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parts, tin cans and broken glass and has probably been intensively surface collected. A large aboriginal petroglyph consisting of concentric circles has been painted yellow and used as a "bulls-eye" by local marksmen. However, there is no evidence of digging. The shelter contains a rectangular, sandstone masonry structure. The walls have been toppled but two courses remain intact. The structure measures _ca_. 5 meters (east-west) by 2.5 meters (north-south). A single Type II projectile point was found on the surface (Fig. 18, a).

_42Un366_: Shallow alcove _ca_. 75 meters long (east-west) and 3 meters deep (north-south). The site has been extensively looted, exposing aeolian deposits to a depth of 25 cm. The deposits contain a great deal of charcoal and a layer of dessicated cottonwood leaves. The surface collection consists of a Type II biface and chipping debris. Three badly weathered, red ochre pictographs appear on the patinated surface of the shelter wall.

_42Un367_: This site was originally recorded by the University of Utah as 42Un109. It was described as a small masonry granary and no mention was made of the deep, extensive deposits in the adjacent alcove. A re-examination suggests that the "granary" is not aboriginal in origin. The site has thus been redefined as a rockshelter and assigned a separate number to prevent confusion with the earlier record. 42Un367 is _ca_. 30 meters long (north-south). The dripline varies from 1.5 to 3.0 meters from the rear wall. The surface collection consists of one Type VII point (Fig. 18, h), one unidentifiable point fragment, one Type II biface, one flake core, and chipping debris. Most of the deposits have been removed and screened. Cultural debris is visible to _ca_. 60 cm. in depth.

_42Un381_: Small shelter _ca_. 9 meters long (north-south) and 2.4 meters from the rear wall to the dripline. The fill consists of aeolian sand, roof scale and charcoal. A large looter's pit has been excavated to a depth of 40 cm. The ceiling is smoke stained. No artifacts other than fire-blackened cobbles are present.

42Un402: Large shelter ca. 75 meters long (east-west) and 10 to 15 meters from the rear wall to the dripline. Fill consists of aeolian sand and animal dung. Chipping debris is scattered over a 75 by 75 meter area below the shelter. Three large thick bifaces, one flake core, two flaked cobbles, and chipping debris were recovered from the surface. A pit has been excavated to a depth of 20 cm.

42Un404: Shelter ca. 30 meters long (north-south) by 5 meters deep (east-west). Aeolian deposits have been eroded away at the front of the shelter to a depth of 1.5 meters. Surface collection consists of one Type XXV projectile point (Fig. 18, i). There is no evidence of vandalism.

42Un407: Water cut shelter along minor tributary arroyo of the White River. Shelter is 45 meters long (east-west) by 3 meters deep (north-south). The ceiling is ca. 3 meters high. There are no surface indications of occupation but two pot holes have exposed alluvial deposits containing charcoal and chipping debris to a depth of 45 cm. One well defined fire-reddened lens visible in profile may be a hearth. One Type II biface fragment was recovered from the excavator's backdirt.

42Un409: Small alcove with very thin aeolian deposit overlying the bedrock floor. Rear wall is smoke blackened and there are numerous fire-cracked river cobbles on the surface. Two large thick bifaces and chipping debris were collected.

OPEN SITES

Open sites consist of sparse concentrations of lithic debris and fire-cracked cobbles. With three exceptions (42Un405, 42Un406, 42Un408), they are situated on Pleistocene terraces along the White River. The depth of deposit varies markedly. The cluster of sites on the south side of the river from 42Un368 through 42Un375 all contain aeolian and colluvial deposits one to two meters deep. However, the open sites on the north side of the river (42Un356, 42Un357, 42Un358, 42Un378, 42Un380, 42Un381) seldom have more than a few centimeters of aeolian sand and most lie directly on terrace gravels. The only exception is 42Un377 which was excavated by Mr. Bud Thompson of Bonanza. This site lies at the base of a steep cliff and is thus protected from wind and water erosion. Mr. Thompson excavated a ca. one square meter area to a depth of 1.2 meters and recovered one hundred and twenty-two lithic artifacts which are reported herein (see Artifacts). The deposits consisted of two charcoal stained layers separated by a thin layer of sterile sand.

Sites 42Un406 and 42Un408 are situated on sandy knolls, respectively, 0.5 and 1.5 miles from the river. They consist of very sparse scatterings of chipping debris.

Site 42Un405 is known locally as Breaking-Wind Butte. Figure 5 is a plan map of the site. It is situated on a flat topped butte ca. 250 meters above the surrounding terrain. A row of upright sandstone slabs lines the northern rim of the butte. The southern rim overlooks a precipitous drop into the White River Canyon. The site contains eighteen oval to sub-rectangular sandstone slab alignments of unknown function. The surface collection consists of one Type I point (Fig. 18, d), one Type II point (Fig. 18, b), one drill (Fig. 19, a), two Type II bifaces, a steatite pipe fragment and chipping debris.

Site 42Un403 is the only isolated example of aboriginal rock art. It

Figure 5

Plan Map of Breaking-Wind Butte (42Un405).

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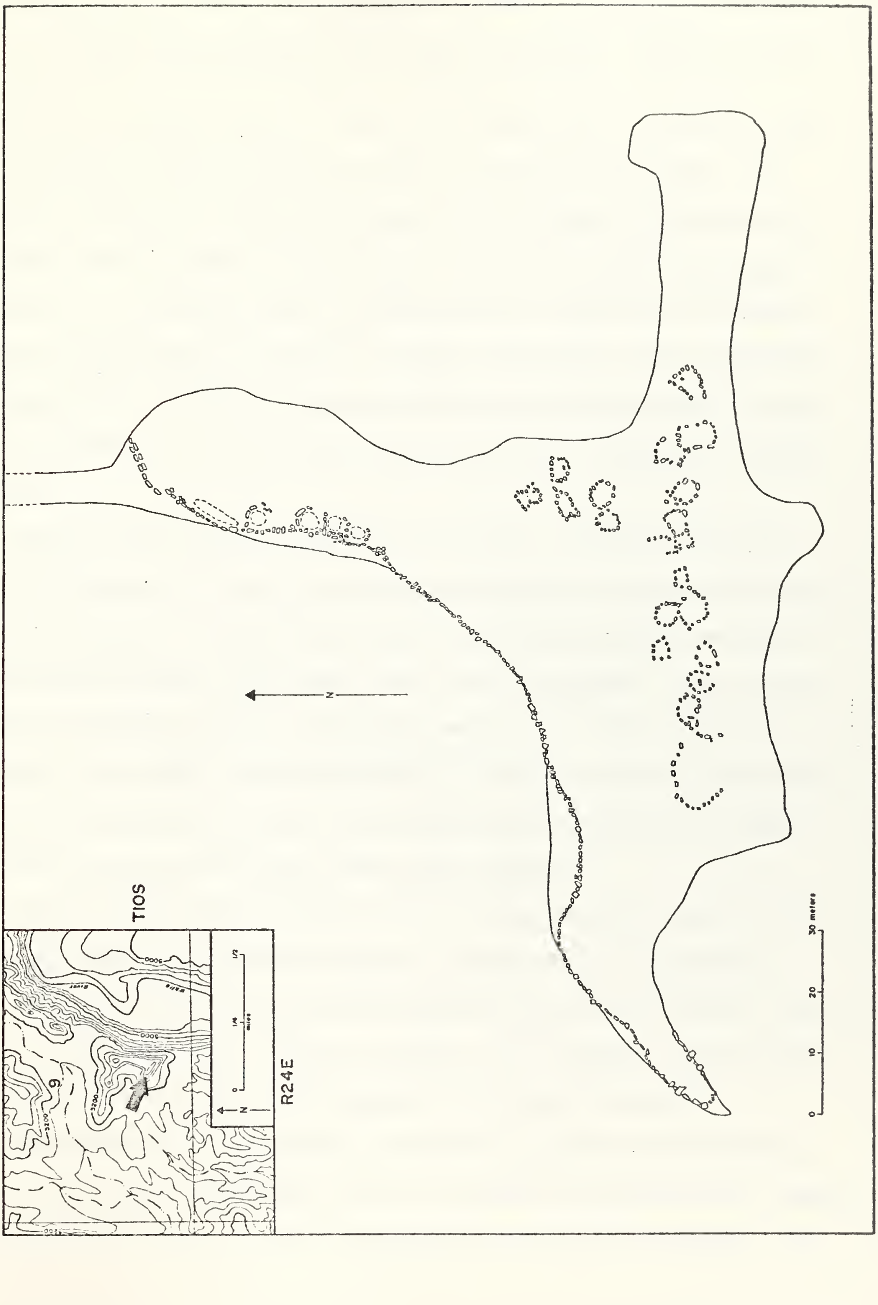
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White
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consists of a big-horn sheep petroglyph on the vertical surface of a sandstone cliff. The animal is _ca_. 20 cm. long by 14 cm. tall.

Discussion

Proximity to the White River was clearly the dominant factor of aboriginal settlement pattern. This is not surprising. The river is the only perennial source of drinking water in this arid environment. The numerous intermittant washes fill quickly during thunder showers but dry up almost instantly when the rain ceases. Evacuation Wash is the only exception. It is a deep gorge that has been cut to bedrock and it holds some water during most of the year. However, the water is quite brackish and unpalatable. Floral and faunal resources are expectably more abundant along the course of the White River than elsewhere in this barren desolate region.

Surface indications of prehistoric occupation are relatively sparse at all of the sites. This is partially attributable to surface collecting by local amateurs. At most of the open sites, chipping debris was found concentrated in small piles rather than evenly distributed. These "piles" probably represent materials rejected by surface collectors in search of "finished" artifacts. The large number of artifacts excavated from 42Un377 suggests that many of the open riverine sites may be considerably richer in yield than the scant surface debris would indicate.

Nearly all of the rockshelter sites have been heavily vandalized. The depth of deposits thus exposed suggests a lengthy record of occupation. Most of these contain some undisturbed deposits with datable material (charcoal, wood, leaves, etc.) visible in profile. The potential for temporally controlled cultural and paleoenvironmental inference is obvious.

Breaking-Wind Butte (42Un405) is the most intriguing site discovered during the survey. The upright slab wall "guards" all access routes, suggesting a defensive position. Other interpretations are equally tenable. The butte commands a view of the river and it would have been an excellent position to observe game movements. Excavation may shed some light on the utilization of the site. Wind erosion has removed most of the deposits but aeolian silts of considerable depth remain at the north end.

The cultural affiliation and temporal span of the sites are questions open to multiple solutions. These matters will be discussed under Conclusions and Recommendations.

ARTIFACTS

A total of two hundred and ninty-one artifacts were recovered by the Antiquities Section investigation. Chipped stone implements and debitage comprise the bulk of the collection. Ground stone, pottery, hammerstones and perishables are poorly represented. Time sensitive or culture specific artifacts are extremely rare.

This small sample imposes serious limits on the level of interpretation. In order to augment the sample and get a better idea of the range of cultures represented in the area we examined private collections recovered in and adjacent to the lease lands. The largest of these was excavated from a single site (42Un377) by Mr. Bud Thompson of Bonanza. Mr. Thompson was kind enough to loan us this collection for detailed analysis. The results are reported below, followed by a description of the materials recovered during the inventory.

The Thompson Collection (42Un377)

The site yielded one hundred and twenty-two lithic implements. These have been subdivided into four categories: Points (Types I through XXV), Drills, Unifaces and Bifaces (Types I through VII).

POINTS

Type I (Fig. 6, a-i)

No. Specimens: 9

Description: All points in this category are isoseles triangular in outline, with thin lenticular to plano-convex cross-sections; lateral edges

Figure 6

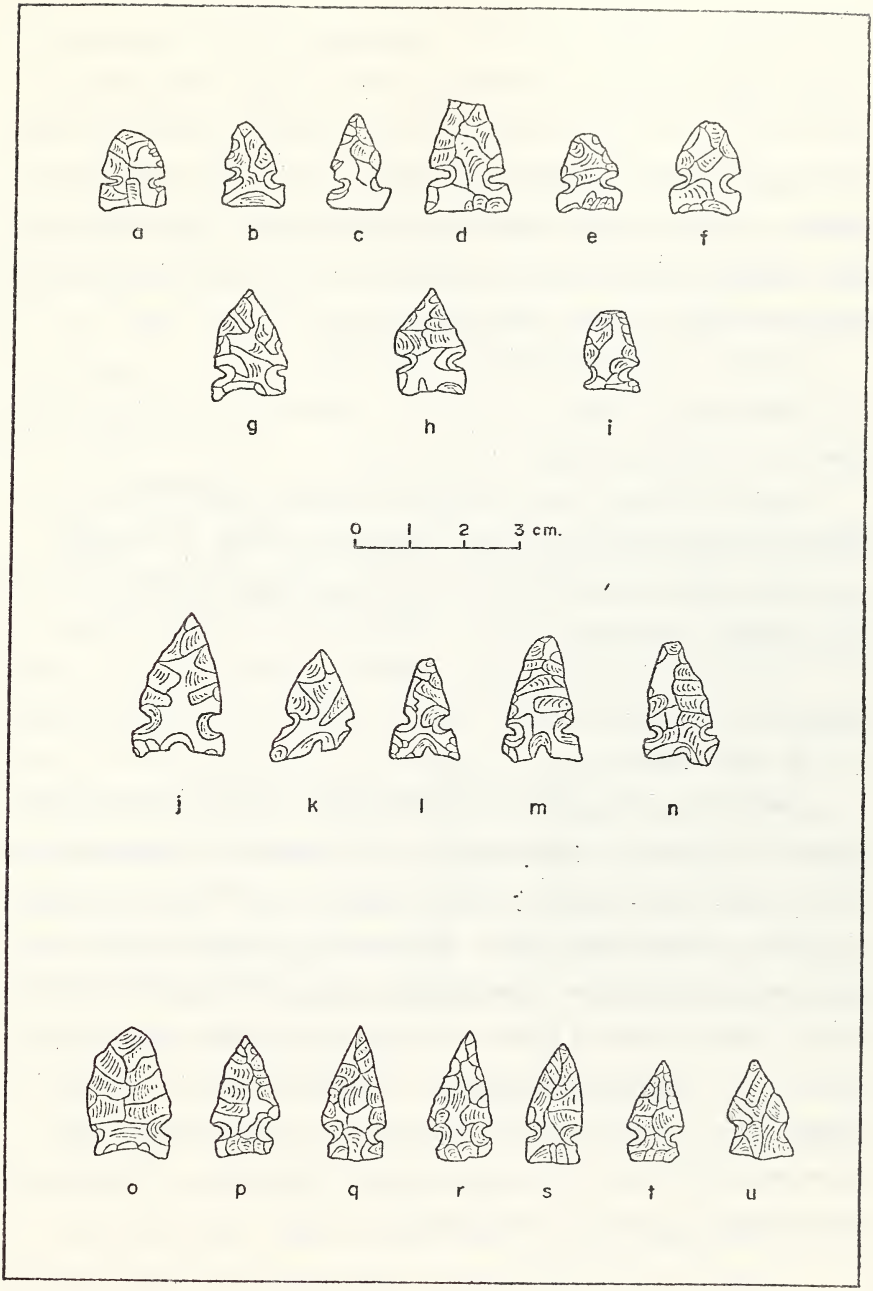
Chipped Stone Artifacts from the Thompson Collection

Points

Type I; a-i

Type II; j-n

Type III; o-u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are straight to slightly excurvate. The greatest width is generally at the top edge of the base. The narrow, moderately deep side notches are placed high on the lateral edges and at a right angle to them. The base of the stem is broad and straight to convex. The corners of the stem are squared. All are pressure flaked with flat collateral flaking most prevalent. Secondary marginal retouch is present on some examples. One specimen has been reworked, forming a sharp acute point.

Material: 8 chert/chalcedony, 1 quartzite

Measurements: Length, 1.5 to 2.4 cm.; width, 1.2 to 1.5 cm.; thickness, 0.2 to 0.4 cm.; weight, 0.4 to 0.9 gm.

Comparable types: Desert side-notched (Aikens 1967, Fig. 38, a-d; Swanson and Bryan 1964, Fig. 5, b-c; Ranere 1971, Plate 13 j; Swanson, Butler and Bonnichsen 1964, Fig. 36, p-q; Aikens 1966, Fig. 22, b-c; Sharrock 1966a, Fig. 42.)

Type II (Fig. 6, j-n)

No. Specimens: 5

Description: These specimens resemble Type I points but are distinguished from them by the presence of a wide V-shaped basal indentation or notch. Type II points are isosceles triangular in outline with straight to slightly convex lateral edges. The position of greatest width is at the lower end of the base. Cross-sections range from biconvex to plano-convex. Side notches are placed relatively high at right angles to the edges, or at a slight angle downward. All bases are notched, forming prominent "spurs." Parallel flaking is present on some specimens. Flake scars generally do not carry beyond midpoint of the blade. Secondary marginal retouch is present on one example.

Material: 4 chert, 1 quartzite

Measurements: Length, 2.0 to 2.8 cm.; width, 1.2 to 1.7 cm.; thickness, 0.2 to 0.4 cm.; weight, 0.5 to 1.7 gm.

Comparable types: Billings double-spur basal notch (Kehoe 1966, Fig. 1); Teotihuacan points, Harrell points (Byers 1967, Figs. 62 and 65); Desert side-notched (Aikens 1970, Fig. 18, a-c; Hunt 1953, Fig. 18, a-i; Gunnerson 1957a, Fig. 14 t; 1969, Fig. 43 d; Day and Dibble 1963, Fig. 21, f-g; Sharrock 1966a, Fig. 48 h).

Type III (Fig. 6, o-u)

No. Specimens: 7

Description: This is a residual category of small side-notched points that could probably be split into two or more types if a larger, well-provenienced collection was available. All are triangular to elongate triangular in outline; most have straight lateral edges although one is slightly concave and one slightly convex. Bases are straight to slightly concave. Cross-sections vary from biconvex to plano-convex. Side notches, with one exception, are relatively shallow and narrow, generally forming bases narrower than the blades, and shoulders that are straight to sloping. Workmanship varies. Most specimens exhibit collateral flake patterns producing a slight ridge along the midline of one or both faces. Two, made on thin flakes, have been marginally retouched only. On one specimen retouch is present only on the ventral face.

Material: 5 chert/chalcedony, 1 quartzite, 1 unknown

Measurements: Length, 1.9 to 2.6 cm.; width, 1.0 to 1.4 cm.; thickness, 0.2 to 0.4 cm.; weight, 0.4 to 1.8 gm.

Comparable types: Ambler (1966b, Fig. 40, k-n); Type 4A, 4C, 4E (Breternitz 1970, see various sites); Shields (1967, Fig. 16, a-c).

Type IV (Fig. 7, a-i)

No. Specimens: 9

Description: Specimens are characterized by elongate triangular outlines, relatively narrow in relation to width. Straight to slightly concave lateral edges, four of which are slightly serrated. Characteristic of the group as a whole are the wide, deep corner notches which form narrow necks and narrow expanding stems with straight to convex bases. Tangs are prominent. Cross-sections range from biconvex to plano-convex. Most appear to be made on thin curved flakes. Medial ridges are present on all but two of the points. Ventral surfaces exhibit the least amount of retouch with much of the original flake surface present. Most flaking is collateral, with flake scars carrying to or short of the medial ridge. Transverse flaking is present on two. Secondary marginal retouch is not present.

Material: 8 chert/chalcedony, 1 jasper

Measurements: Length, 2.0 to 2.8 cm.; width, 0.9 to 1.6 cm.; thickness, 0.3 to 0.4 cm.; weight, 0.3 to 1.4 gm.

Comparable types: Aikens (1970, Fig. 18, j-l), Hunt (1953, Fig. 10, a-e), Type C (Wormington 1955, Fig. 32), Wormington and Lister (1956, Fig. 40, a-d, Fig. 41, a-f), Brew (1946, Fig. 172, a-g), Type 3E, Breternitz (1970, Fig. 2, see various sites), Ambler (1966b, Fig. 40, o), Burgh and Scoggin (1948, Fig. 21), Lister (1951, Fig. 4), Gunnerson (1957a, Fig. 14, b-e, x-y).

Type V (Fig. 7, j-n)

No. Specimens: 5

Description: All specimens are triangular in outline with straight lateral edges and straight to slightly convex bases. The smallest specimen

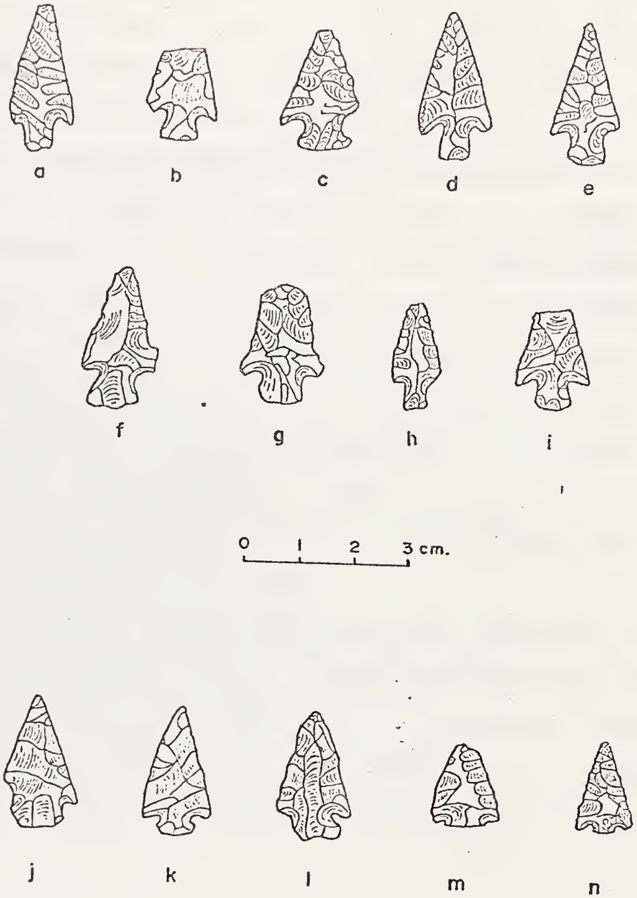
Figure 7

Chipped Stone Artifacts from the Thompson Collection

Points

Type IV; a-i

Type V; j-n


a
b
c
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e
f
g
h
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0 1 2 3 cm.
j
k
l
m
n

has serrated edges. All examples are characterized by narrow corner notches which form prominent tangs and expanding bases narrower than the blade. Cross-sections are biconvex to plano-convex. One specimen is twisted (Fig. 7, 1). Flaking is collateral or non-patterned with flake scars rarely carrying more than half way across the blade. On two specimens the original ventral flake surface is still present. Two of the specimens are distinctly smaller than the others, but have been placed in this category on the basis of shape, notching and flaking.

Material: 3 chert, 2 jasper

Measurements: Length, 1.2 to 2.4 cm.; width, 1.0 to 1.4 cm.; thickness, 0.2 to 0.4 cm.; weight, 0.2 to 1.0 gm.

Comparable types: Type 3E, Breternitz (1970, Fig. 2, see various sites); Wormington (1955, Fig. 32).

Type VI (Fig. 8, a-d)

No. Specimens: 4

Description: Specimens in this group are characterized by elongate triangular outlines, straight lateral edges, and lenticular cross-sections. The bases on three are indented, one is slightly convex. Corner notches are of medium width and depth, forming bases nearly as wide as the blades. Workmanship is good. Flake scars are random or non-patterned with most flake scars carrying across the midline of the blades.

Material: 3 chert/chalcedony, 1 unknown

Measurements: Length, ? to 3.2 cm.; width, 1.5 to 1.9 cm.; thickness, 0.3 to 0.4 cm.; weight, 1.6 to 2.0 gm.

Comparable types: Type 3, Breternitz (1970, Fig. 2); Type W18, Jennings (1957, Fig. 89a); Wormington and Lister (1956, Fig. 8b); Day and

Figure 8

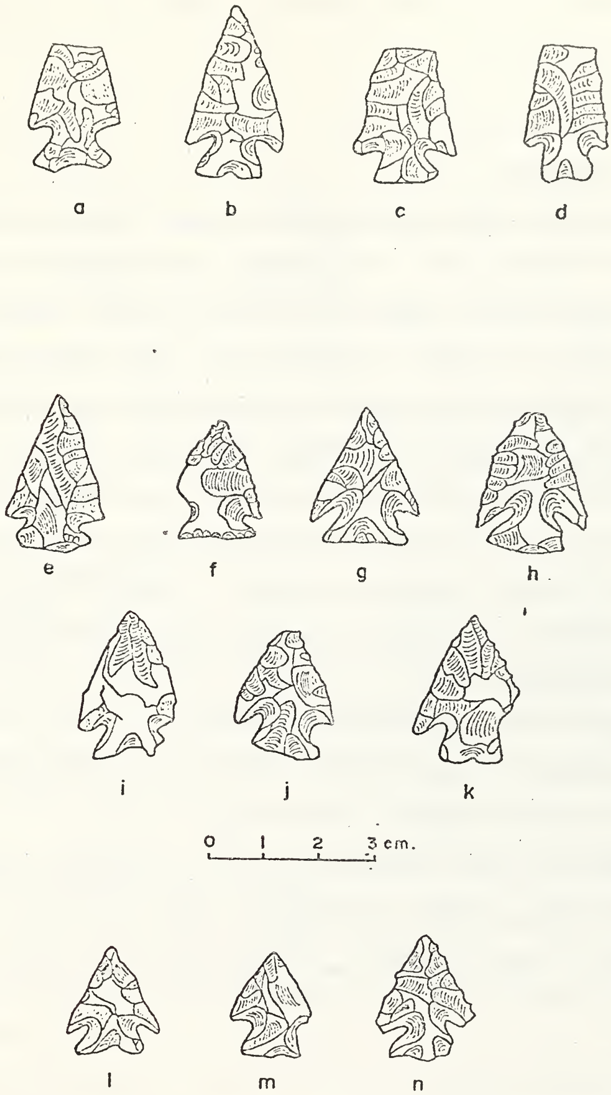
Chipped Stone Artifacts from the Thompson Collection

Points

Type VI; a-d

Type VII; e-k

Type VIII; l-n


a
b
c
d
e
f
g
h
i
j
k
0 1 2 3 cm.
l
m
n

Dibble (1963, Fig. 5 i); Swanson and Bryan (1964, Fig. 5 h); Type 4B, Leach (1970, Plate 6, j-k).

Type VII (Fig. 8, e-k)

No. Specimens: 7

Description: These points resemble those in Type VI, but have been separated because of their relatively wide blades and deeper corner notches. With one exception, the blades are as wide as or wider than they are long. Lateral edges are straight to slightly convex. The margins on three are slightly serrated. Bases range from slightly convex to indented, although the majority are straight, and expand to nearly the width of the blade. Tangs are very pronounced, drooping markedly on most specimens. Cross-sections are generally lenticular although a slight medial ridge is present on several specimens. Flake scars on most of the points are random. On one the original flake surface is present on both faces; it may have been broken during manufacture.

Material: 6 chalcedony/chert, 1 unknown

Measurements: Length, 2.2 to 2.8 cm.; width, 1.6 to 2.0 cm.; thickness, 0.3 to 0.5 cm.; weight, 1.4 to 2.0 gm.

Comparable types: Breternitz (1970, Fig. 2); Swanson and Sneed (1966, Fig. 18 n); Swanson, Butler and Bonnichsen (1964, Fig. 36 g); similar to Type TB6, Sharrock (1966a, Fig. 39), and to Type 4g, Leach (1970, Plate 7, i-p).

Type VIII (Fig. 8, l-n)

No. Specimens: 3

Description: These three points have equilateral triangular outlines, with relatively broad blades, lenticular cross-sections, and straight lateral edges. On one, the blade edges are irregularly serrated, the other two specimens exhibit minute, relatively steep retouch along portions of the blade edges. Corner notching varies, but has produced well-developed tangs and expanding stems on all specimens. Bases are concave on two, straight on the third. Flaking is largely non-patterned although parallel oblique flake scars are present, stopping at or just short of the midline.

Material: 2 chalcedony, 1 welded tuff

Measurements: Length, 1.9 to 2.2 cm.; width, 1.5 to 1.8 cm.; thickness, 0.3 to 0.4 cm.; weight, 1.0 to 1-2 gm.

Comparable types: Types 2G and 4a, Breternitz (1970, Fig. 2); Wormington and Lister (1956, Fig. 43 b); Hunt (1953, Fig. 12, a-h); Prairie side-notched (Kehoe 1966, Fig. 1).

Type IX (Fig. 9, a-c)

No. Specimens: 3

Description: These points have elongate triangular outlines with straight blade edges, flat lenticular cross-sections. Corner notches are relatively deep and narrow, producing tangs which come down almost to the base of the stems. The bases are straight to slightly concave, with sharp lateral corners. Transverse parallel flaking is present on the broken specimen, with flake scars carrying to or beyond the midpoint. Fine marginal retouch on one face has produced serrated lateral edges. The complete point exhibits well-controlled collateral flaking and fine serrations. The third point may have been broken during manufacture. Both faces have been completely flaked only near the tip, otherwise only along the margins.

Material: 3 chert/chalcedony

Measurements: Length, 3.2 to 3.4 cm.; width, 1.8 to 2.0 cm.; thickness,

Figure 9

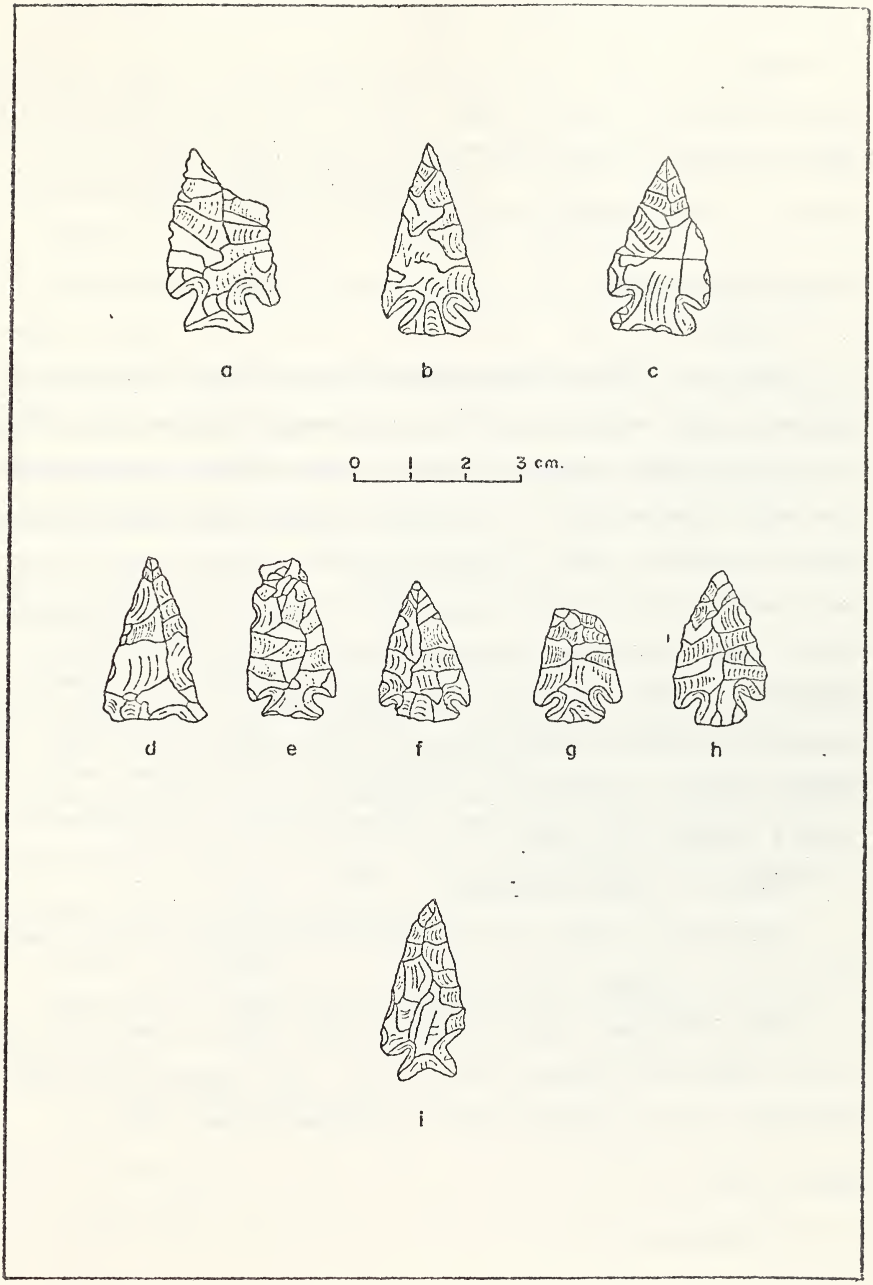
Chipped Stone Artifacts from the Thompson Collection.

Points

Type IX; a-c

Type X; d-h

Type XI; i


a
b
c
0 1 2 3 cm.
d
e
f
g
h
i

0.3 to 0.4 cm.; weight, 1.5 to 1.7 gm.

Comparable types: Type 3, Breternitz (1970, Fig. 2); Hunt (1953, Fig. 14, 15): Kidder and Guernsey (1919, Fig. 48, c, d); Burgh and Scoggin (1948, Fig. 22); resembles Elko Corner-notched (Aikens 1970), TB8 (Sharrock 1966a, Fig. 41); Type 4d (Leach 1970, Plate 7, a-e).

Type X (Fig. 9, d-h)

No. Specimens: 5

Description: These points resemble those in Type IX, but are distinguished by their smaller size and type of notching. Specimens have elongate triangular outlines, straight or slightly excurvate lateral margins, and lenticular cross-sections. A slight medial ridge, most pronounced near the point, is present on three. Notches are shorter, narrower, and at a more acute angle to the stem than those of Type IX, producing less-pronounced tangs. Bases are straight, expanding to nearly the width of the blades. Transverse parallel, collateral, and chevron flaking are all present, with flake scars generally carrying across or to the midpoint of the blade. Fine marginal retouch is present on two examples. On one of these it has produced a low bevel on one edge.

Material: 5 chert/chalcedony

Measurements: Length, 2.6 to 3.3 cm.; width, 1.6 to 1.8 cm.; thickness, 0.3 to 0.4 cm.; weight, 1.1 to 1.8 gm.

Comparable types: Type 3, Breternitz (1970, Fig. 2); Hunt (1953, Fig. 14, 15); Kidder and Guernsey (1919, Fig. 48, c, d); Wormington and Lister (1956, Fig. 43, i), resembles Elko Corner-notched (Aikens 1970).

Type XI (Fig. 9, i)

No. Specimens: 1

Description: This point is elongate triangular in outline, with straight lateral margins and a thin lenticular cross-section. Deep narrow corner notches and a pronounced basal indentation have formed a distinctive, eared stem. Workmanship is good, characterized by flat collateral flaking. Flake scars generally end at the midpoint.

Material: chert

Measurements: Length, 3.3 cm.; width, 1.5 cm.; thickness, 0.3 cm.; weight, 1.3 gm.

Comparable types: Elko Split Stem (Aikens 1970, Fig. 20, m-r);Sharrock (1966a, Fig. 48,e); Wormington and Lister (1956, Fig. 47); Swanson, Butler and Bonnichsen (1964, Fig. 37, c); Heizer and Baumhoff (1961, Fig. 4); Gunnerson (1957a, Fig. 14, aa).

Type XII (Fig. 10, a)

No. Specimens: 1

Description: This point is triangular in outline with a straight lateral margin (other margin is missing), wide convex base nearly as long as the lateral margin, and a flat lenticular cross-section. Notching appears to be assymetrical, producing the wide, short base. Flat collateral and parallel oblique flaking is present. Flake scars feather out at midpoint. The base has been bifacially thinned.

Material: chalcedony

Measurements: Length, 3.0 cm.; width, 2.1 cm.; thickness, 0.3 cm.; weight, 1.8 gm.

Comparable types: none known

Type XIII (Fig. 10, b)

No. Specimens: 1

Figure 10

Chipped Stone Artifacts from the Thompson Collection

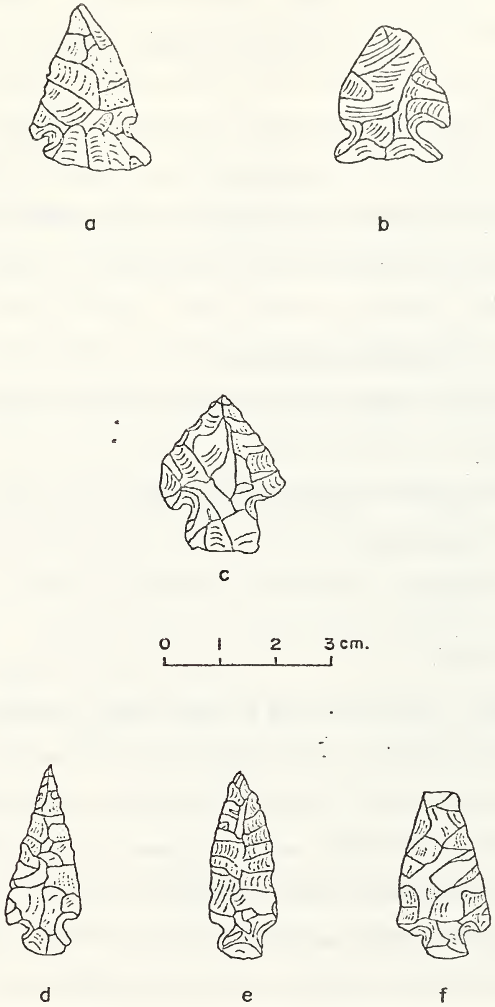
Points

Type XII; a

Type XIII; b

Type XIV; c

Type XV; d-f


a
b
c
0
1
2
3 cm.
d
e
f

Description: This point is triangular in outline. The blade is wide and relatively short. The lateral margin is convex (the other margin is missing) with an irregular edge. Cross-section is irregularly plano-convex. Corner notches are deep, producing prominent tangs and an expanding stem as wide as the blade. The base of the stem is also irregular (unfinished?). Part of the original flake surface is present on one face. The difference in appearance between this surface and the surface of the flake scars indicates that the point was heat treated during manufacture. It may have been broken during manufacture with the removal of a large flake from near the tip.

Material: transparent chalcedony

Measurements: Length, 2.8 cm.; width, 2.2 cm.; thickness, 0.3 cm.; weight, 2.0 gm.

Comparable types: Sharrock (1966a, Fig. 47, f, n), Class IX, Day and Dibble (1963, Fig. 5, n).

Type XIV (Fig. 10, c)

No. Specimens: 1

Description: This point has a wide, short, triangular blade with straight lateral edges and a flat lenticular cross-section. The shoulders are pronounced and slightly tanged. The stem is relatively large, slightly expanding, and has a straight base. The base has been thinned by removal of long flakes which carry beyond the neck of the point. Flaking is mainly random but generally well-controlled. Parallel oblique flake scars are present near the tip, carrying almost as far as the neck.

Material: chert

Measurements: Length, 2.9 cm.; width, 2.3 cm.; thickness, 0.5 cm.; weight, 2.6 gm.

Comparable types: Class I, Day and Dibble (1963, Fig. 5, a); Fowler (1968, Fig. 3, 5), Type 2B, Breternitz (1970, Fig. 2).

Type XV (Fig. 10, d-f)

No. Specimens: 3

Description: These points are characterized by narrow elongate triangular blades, with straight to moderately excurvate lateral margins. Two have lenticular cross-sections. One, made on a slightly curved flake, has a plano-convex cross-section. Wide, moderately deep corner notches have formed well-developed shoulders and relatively short, slight to moderately expanding stems, with rounded bases. Both flat collateral and oblique flaking is present. The plano-convex specimen has a pronounced medial ridge on one face, the others have only slight ridges, most prominent near the points.

Material: 1 chert, 1 translucent chalcedony, 1 quartzite

Measurements: Length, 3.4 to 3.5 cm.; width, 1.3 to 1.7 cm.; thickness, 0.3 to 0.4 cm.; weight, 1.2 to 1.7 gm.

Comparable types: Aikens (1970, Fig. 18, d-f); Hunt (1953, Fig. 11, b).

Type XVI (Fig. 11, a)

No. Specimens: 1

Description: This large, unique point has an isosceles triangular blade with slightly excurvate lateral margins, a flat lenticular cross-section and small, but pronounced tangs. The most distinctive feature of the point is the stem which is 1.2 cm. long. The stem has a wide, relatively long, straight neck which flares abruptly near the base forming a base

Figure 11

Chipped Stone Artifacts from the Thompson Collection.

Points

Type XVI; a

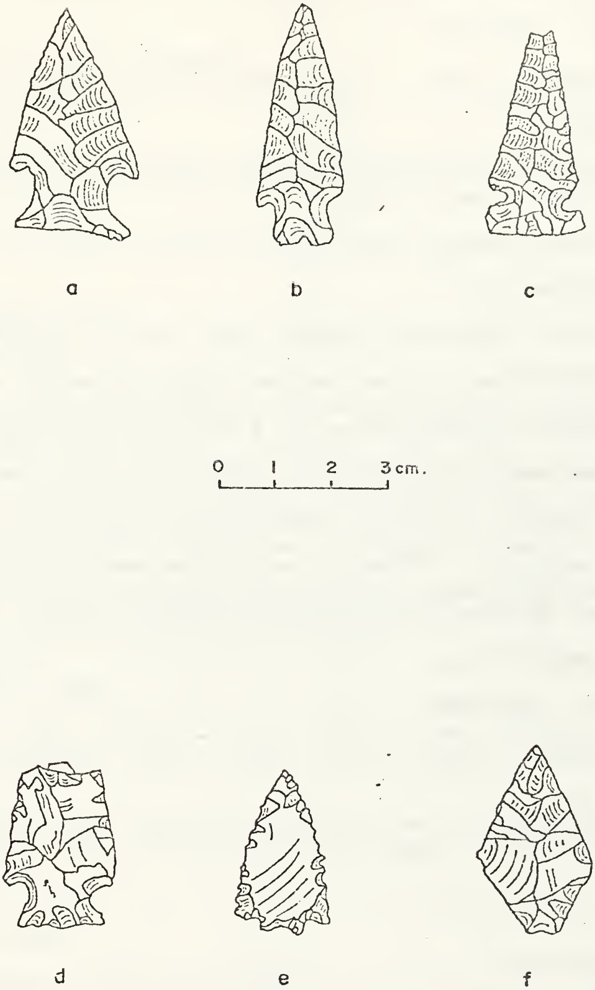
Type XVII; b

Type XVIII; c

Type XIX; d

Type XX; e

Type XXI; f


a
b
c
0 1 2 3 cm.
d
e
f

slightly narrower than the blade. The base has been bifacially thinned and is slightly concave. Flaking is collateral or non-patterned.

Material: chalcedony

Measurements: Length, 4.1 cm.; width, 2.2 cm.; thickness, 0.5 cm.; weight, 3.5 gm.

Comparable types: Type 4F, Breternitz (1970:140, Fig. 9, k).

Type XVII (Fig. 11, b)

No. Specimens: 1

Description: This point resembles those classified as Type XV, but is considerably larger. It has a narrow, elongate triangular outline, slightly excurvate lateral margins, and a biconvex to lenticular cross-section. Shoulders are pronounced with slight tangs. The stem, formed by wide corner notches, is slightly expanding with a rounded base. The base has a small notch in it. A low, but well-defined medial ridge is present on both faces, produced by well-controlled parallel flaking. Flake scars meet at the medial ridge.

Material: chalcedony

Measurements: Length, 4.4 cm.; width, 1.7 cm.; thickness, 0.5 cm.; weight, 3.5 gm.

Comparable types: Aikens (1970, Fig. 18, d-f); Hunt (1953, Fig. 11, b).

Type XVIII (Fig. 11, c)

No. Specimens: 1

Description: This side-notched point has a narrow elongate triangular outline, straight lateral margins and base, and a biconvex cross-section. The widest point is at the base. Moderately wide side notches are placed at right angles to the lateral edges, producing a base with square ends. Well-controlled parallel flaking is present on both faces. Flake scars carry as far as the midpoint, producing a definite medial ridge.

Material: chert/chalcedony

Measurements: Length, 3.9 cm.; width, 1.8 cm.; thickness, 0.4 cm.; weight, 2.7 gm.

Comparable types: Bitterroot side-notched, Swanson, Butler and Bannichsen (1964, Fig. 36 ,d); Swanson and Sneed (1966, Fig. 20, b-c).

Type XIX (Fig. 11, d)

No. Specimens: 1

Description: This point is isosceles triangular in outline, with straight lateral margins and a plano-convex cross-section. It is characterized by wide corner notches, shoulders with a slight tang, a wide neck, and an expanding stem with a straight base. The point was made on a slightly twisted flake and the ventral surface has been flaked along the margins only. The dorsal surface has been completely worked.

Material: chert

Measurements: Length, 3.7 cm.*; width, 2.1 cm.; thickness, 0.5 cm.; weight, 4.0 gm.*.

Comparable types: Sharrock (1966a, Fig. 48, f), Hunt (1953, Fig. 13).

Type XX (Fig. 11, e)

No. Specimens: 1

Description: This point was made on a thin, expanding, curved flake. It is isosceles triangular in outline, with slightly convex lateral edges and a plano-convex cross-section. Relatively wide, V-shaped, shallow basal notches have produced barbs that come down almost to the base, and a short straight-sided stem with an indented base. The dorsal surface is completely worked. The ventral surface has been retouched along the edges, producing serrated lateral margins. The tip has been extensively retouched.

---

* Slightly less than half the point is missing.

Material: chert

Measurements: Length, 2.9 cm.; width, 1.7 cm.; thickness, 0.3 cm.; weight, 1.3 gm.

Comparable types: none

Type XXI (Fig. 11, f)

No. Specimens: 1

Description: The specimen is leaf-shaped in outline with an isosceles triangular blade, rounded sloping shoulders, and a sharply contracting stem. It is lenticular in cross-section with a slight medial ridge on one face. The base is narrow and slightly concave. Well-controlled, flat collateral flaking is present. Flake scars do not carry beyond the midline.

Material: chert

Measurements: Length, 3.4 cm.; width, 2.0 cm.; thickness, 0.5 cm.; weight, 2.8 gm.

Comparable types: Pinto sloping shoulder, Aikens (1970, Fig. 21, h); Fowler (1968, Plate 1, q).

Type XXII (Fig. 12, a-i)

No. Specimens: 9

Description: While there is variation in size within this category, the examples appear to intergrade and possess basic similarities. Blades range from lanceolate to triangular depending on the length of the point, with blade edges incurved toward the tip. On the largest specimen, the

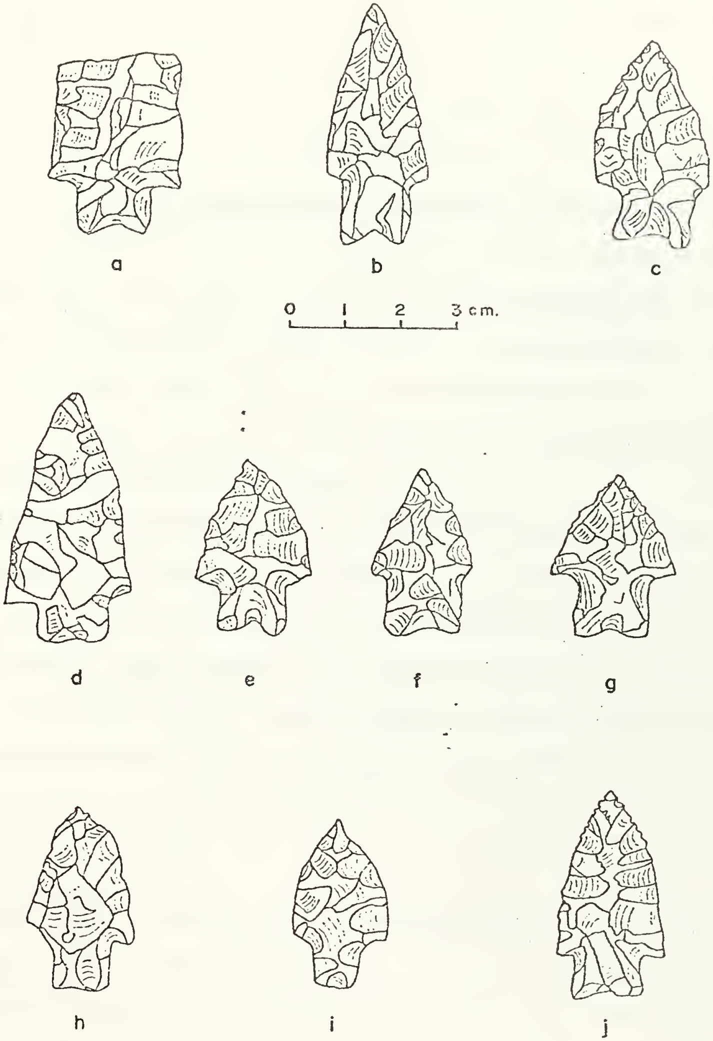

a
b
c
0 1 2 3 cm.
d
e
f
g
h
i
j

Figure 12

Chipped Stone Artifacts from the Thompson Collection

Points

Type XXII; a-i

Type XXIII; j

edges of the proximal blade-half are parallel. Probably the most distinctive characteristic of the group is the stem. On five specimens it is straight-sided. On three examples, the proximal end of the base is slightly expanding. Only one is slightly contracting. Six of the bases are shallowly notched, three are straight. With the exception of the contracting-stemmed point, stem widths range from 1.2 to 1.3 cm. and lengths from 0.7 to 1.0 cm. Shoulders are prominent and generally straight, although some are slightly rounded or tanged. Cross-sections range from lenticular to biconvex. Hinge fractures are frequent and flakes do not commonly extend beyond the blade midpoint. The edges tend to be slightly irregular, produced principally by primary flaking. Secondary marginal retouch is rare. Parallel flaking is present only on the larger point (Fig. 12, a). One of the points (Fig. 12, i) is aberrant. It may not belong in this category but has been placed here since its stratigraphic position is unknown.

Material: 3 chert/chalcedony, 7 silicified sedimentary stone

Measurements: Length, 2.9 to 7.4 (est.) cm.; width, 1.7 to 2.3 cm.; thickness, 0.3 to 0.4 cm.; weight, 1.9 to 9.0 (est.) gm.

Comparable types: McKean points, Mulloy (1954, Fig. 4, 31-40, lower level; Leach 1966a, Fig. 3t); Type TB5, Sharrock (1966a, Fig. 38); Class VIII, Day and Dibble (1963, Fig. 5, k-m); Type 2h, Leach (1970, Plate 3, h, k-m).

Type XXIII (Fig. 12, j)

No. Specimens: 1

Description: This point has a lanceolate blade, incurved toward the tip, and a thin lenticular cross-section. The square shoulders are prominent, with a slight barb. The broad corner notches form a relatively long, slightly expanding stem with a concave base. The base has been further modified by longitudinal thinning flakes on both faces that extend up onto the blade. Thin parallel flakes feather out at or short of the midpoint. Step fractures are present on one face. While this point has much the same outline as those classified as Type XXII, it differs noticably in flaking technique, thinness, and by the presence of slight tangs.

Material: quartzite

Measurements: Length, 3.7 cm.; width, 1.9 cm.; thickness, 0.4 cm.; weight, 2.6 gm.

Comparable types: Type 2d, Leach (1970, Plate 3, e-g); Sharrock (1966a, Fig. 47 b, c, Fig. 48 b); Frison (1968, Fig. 3, m-p).

Type XXIV (Fig. 13, a)

No. Specimens: 1

Description: This specimen is lanceolate in outline, with a thin lenticular cross-section, and deeply indented base. One proximal lateral edge is slightly constricted forming a scarcely perceptible stem, defined by a slight shoulder. The opposite edge has a shallow notch just above the point where the base is broken. Oblique parallel flake scars are present, with most flakes extending beyond the blade midpoint. A few end in step fractures, probably a result of the poor quality of the material. Secondary bifacial marginal retouch is present along both lateral edges.

Material: quartzite

Measurements: Length, 4.4 cm.; width, 2.1 cm.; thickness, 0.5 cm.; weight, 8.2 gm.

Comparable types: W 10, Jennings (1957, Fig. 81); McKean points, Mulloy (1954, Fig. 4, No. 23, 27, lower level).

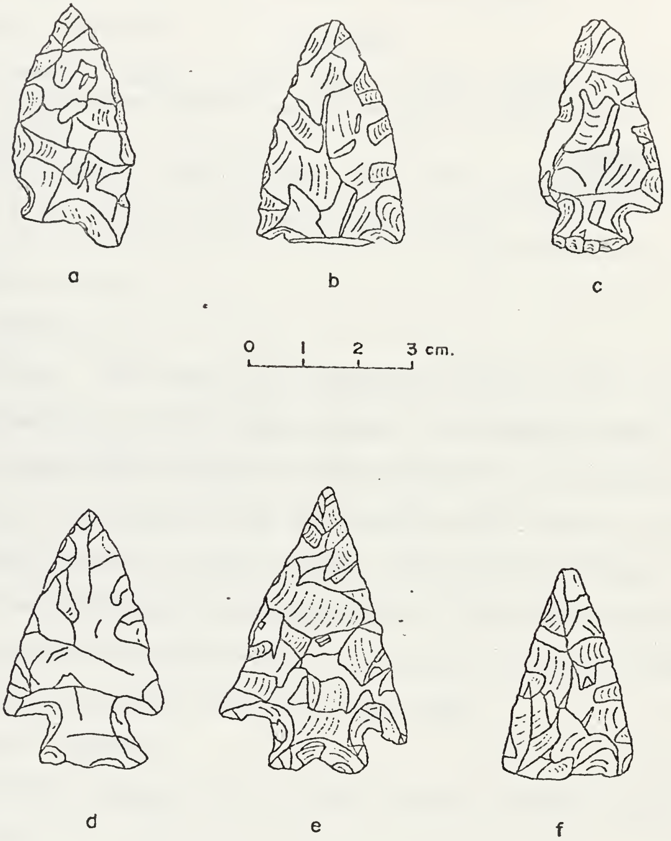
Figure 13

Chipped Stone Artifacts from the Thompson Collection.

Points

Type XXIV; a

Type XXV; b-f


a
b
c
0 1 2 3 cm.
d
e
f

Type XXV (Fig. 13, b-f)

No. Specimens: 5

Description: This category consists of large triangular corner-notched points which, because of their size, are believed to have been used as hafted knives. Some of the lateral edges also evidence signs of wear in the form of small flakes which have been removed, perhaps indicating use other than as projectile points. Stems on all examples are expanding and barbs are prominent. Hinge fractures are numerous, in many cases clearly a result of the non-homogenous nature of the material. All specimens have relatively thin lenticular to biconvex cross-sections. Secondary marginal retouch is present on two.

Material: 2 quartzite, 2 chert, 1 silicified sedimentary stone

Measurements: Length, 4.3 to 5.2 cm.; width, 2.2 to 3.5 cm.; thickness, 0.5 to 0.6 cm.; weight, 3.5 to 6.6 gm.

Comparable types: Leach (1970, Plate 8, a-b); Day and Dibble (1963 Fig. 5, h); Sharrock (1966a, Fig. 48, a).

DISCUSSION OF POINTS

Types I and II fall within the range of variation of the Desert Side-Notched (Baumhoff and Byrne 1959) as defined in the Great Basin. Type II is also formally identical to the Billings Double Spur Basal-Notched of the Northwestern Plains (Kehoe 1966). This geographically widespread point type has been dated from ca. 650 B.P. to the historic period (Baumhoff and Byrne 1959; Hester 1972). Its posited occurrence at 3000 B.P. in the Hogup Cave sequence (Aikens 1970) was based on erroneous interpretations of the stratigraphic and radiometric data (cf. Madsen and Berry 1975).

Type III is a non-diagnostic point found virtually everywhere in western North America. In Utah, they have been recovered from inumerable surface sites of unknown affiliation as well as from several poorly dated Fremont sites. The temporal range is probably similar to that posited for Types I and II.

Types IV and V are similar to the small corner-notched points associated with the Uncompahgre Complex (Wormington and Lister 1956) in the Utah-Colorado border area and Late Woodland sites (Johnson 1974) between the Colorado Front Range and the Missouri River. It is formally identical with the Great Basin type Eastgate Expanding-Stem (Lanning 1963; Clewlow 1967) and Pueblo I points of the Four Corners area (Brew 1946). These points occur as early as 1450 B.P. on the Plains (Johnson 1974) and from 1350 to 650 B.P. in the Great Basin (Lanning 1963; Clewlow 1967).

Types I through V are probably arrow points based on their temporal provenience and stratigraphic association at various sites in western North America with the remains of bow and arrow fragments. Type VIII may also be an arrow point. Similar forms are referred to as Prairie Side-Notched on the Northwest Plains and have been dated to ca. 1200 B.P. (Kehoe 1966).

Types VI, VII, and IX through XXI are probably atlatl points and therefore attributable to the Archaic Period or, possibly, Basketmaker II. Obviously no unequivocal temporal assignation is possible. Similar points have been recovered from Danger Cave in strata dated as early as 9800 B.P. (Jennings 1957) and from the basal stratum of Hogup Cave (Aikens 1970) dated at 8400 B.P. At Deluge Shelter in the Uinta Basin (Leach 1970) they were found in association with the earliest Archaic deposits dated at ca. 3800 B.P. However, if Basketmaker II affiliation can eventually be demonstrated, they may date in the 2000 to 1500 B.P. range.

Type XXII falls within the range of variation of McKean points (Mulloy 1954). McKean points date to 3800 B.P. at Deluge Shelter (Leach 1970), and 3300 B.P. at the type site (Mulloy 1954)

Types XXIII through XXV are essentially non-diagnostic.

DRILLS (Fig. 14, a-c)

No. Specimens: 3

Description: Two of the drills are characterized by long slender drill blades, bifacially flaked along both lateral edges. Both have thick lenticular to lozenge-shaped cross-sections produced by relatively steep flaking. The expanding base which is present on one is bifacially flaked over both surfaces and unnotched. The base is slightly concave. The third specimen appears to be made on the stem of a projectile point (whose tip was broken off), by reworking the stem into a short triangular point. This point is bifacially flaked, forming a thick strong drill point, diamond-shaped in cross-section.

Material: 2 chert/chalcedony, 1 unknown

Measurements: Length, 4.1 cm. (b), 2.1 cm. (c); width of base (a), 2.2 cm.; width of blade (a, b), 0.8 cm.; thickness of base (a), 0.6 cm.; thickness of blade, 0.3 cm. (a), 0.6 cm. (b).

UNIFACES (Fig. 14, d-h)

No. Specimens: 5

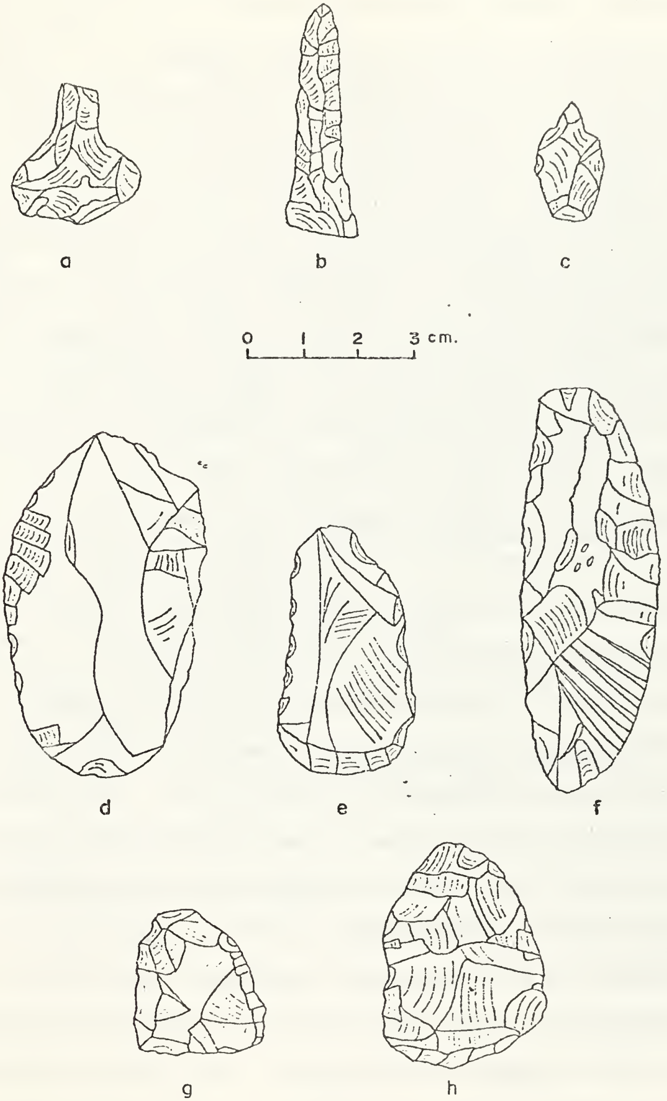
Description: Figure 14, d is made on a long thick flake, wedge-shaped in cross-section with a dorsal ridge adjacent to one lateral edge. This edge is at a 90° angle to the ventral surface, and exhibits numerous step fractures on the dorsal face usually ascribed to use. The opposite lateral

Figure 14

Chipped Stone Artifacts from the Thompson Collection.

Drills; a-c

Unifaces; d-h


a
b
c
0 1 2 3 cm.
d
e
f
g
h

edge is at a much lower angle and has been retouched by removal of relatively long flat flakes on the dorsal surface. The distal end is also retouched and exhibits tiny step fractures on the edge of the dorsal surface. Fig. 14, e is made on a long, flat flake and is assymetrically triangular in cross-section. Both lateral edges are steeply retouched by the removal of short flakes. The distal edge has been completely retouched by removal of longer, less steep, flakes. Small jagged use flakes have been removed around the entire margin on the dorsal face, but are concentrated at the two corners of the distal end. A smooth facet has also been worn along the ventral edge of the distal end. Fig. 14, f is made on a blade. The dorsal surface has been entirely flaked. The edges are retouched around the entire margin producing one lateral edge that is straight and at a steep angle. The other is convex and at a lower angle. The ventral surface is flat. A few flakes have been removed, apparently to resharpen the edge. Tiny use flakes have been removed from the dorsal face, producing a rough edge. These are concentrated in the center of each lateral edge. Figure 14 g, h, are made on expanding, curved flakes, triangular in outline. The entire dorsal surface is flaked. The transverse edge is steeply retouched on both specimens. The smaller of the two, has one steeply retouched lateral edge. Two spurs have also been produced at the distal corners. These spurs and all retouched margins exhibit evidence of use in the form of tiny step fractures along the dorsal edges. Small use flakes occur along the lateral edges of the ventral face on both specimens.

Material: 4 chert/chalcedony, 1 quartzite

Measurements: Length, 2.6 to 7.3 cm.; width, 2.2 to 3.4 cm.; thickness, 0.5 to 1.1 cm.; weight, 4.1 to 30.9 gm.

BIFACES

Bifaces, Type I (Fig. 15, a-h)

No. Specimens: 8

Description: All of the specimens placed in this category are probably preforms for projectile points (almost certainly arrow points), or small knives. All that would be required is secondary retouch to straighten and thin the edges or to reduce the point (bulb of force), and notching to facilitate hafting. All the specimens have thin cross-sections which are biconvex, flat lenticular or plano-convex. Outlines vary, but most are periform or triangular with straight to rounded bases. One base is concave. One specimen made on a thin expanding flake is worked on the dorsal face only, with no modification of the bulb of force. Another has been marginally retouched on the ventral face only, and the bulb of force has been removed. On a few, one or more edges have been turned (beveled) to provide a platform for removal of flakes from the opposite face.

Material: 8 chert/chalcedony (all different)

Measurements: Length, 2.3 to 3.1 cm.; width, 1.0 to 1.8 cm.; thickness, 0.2 to 0.3 cm.; weight, 0.7 to 1.7 gm.

Comparable types: Cottonwood triangular, Leach (1970, Fig. 1, a-l).

Bifaces, Type II (Fig. 15, i-l)

No. Specimens: 4

Description: The four examples in this category appear to be unfinished bifaces; probably blanks for knives or large projectile points. All are characterized by lanceolate to elongate triangular outlines with convex bases. Two have rounded tips. They range from biconvex to lenticular in cross-section. The edges on all specimens are slightly sinuous and irregular.

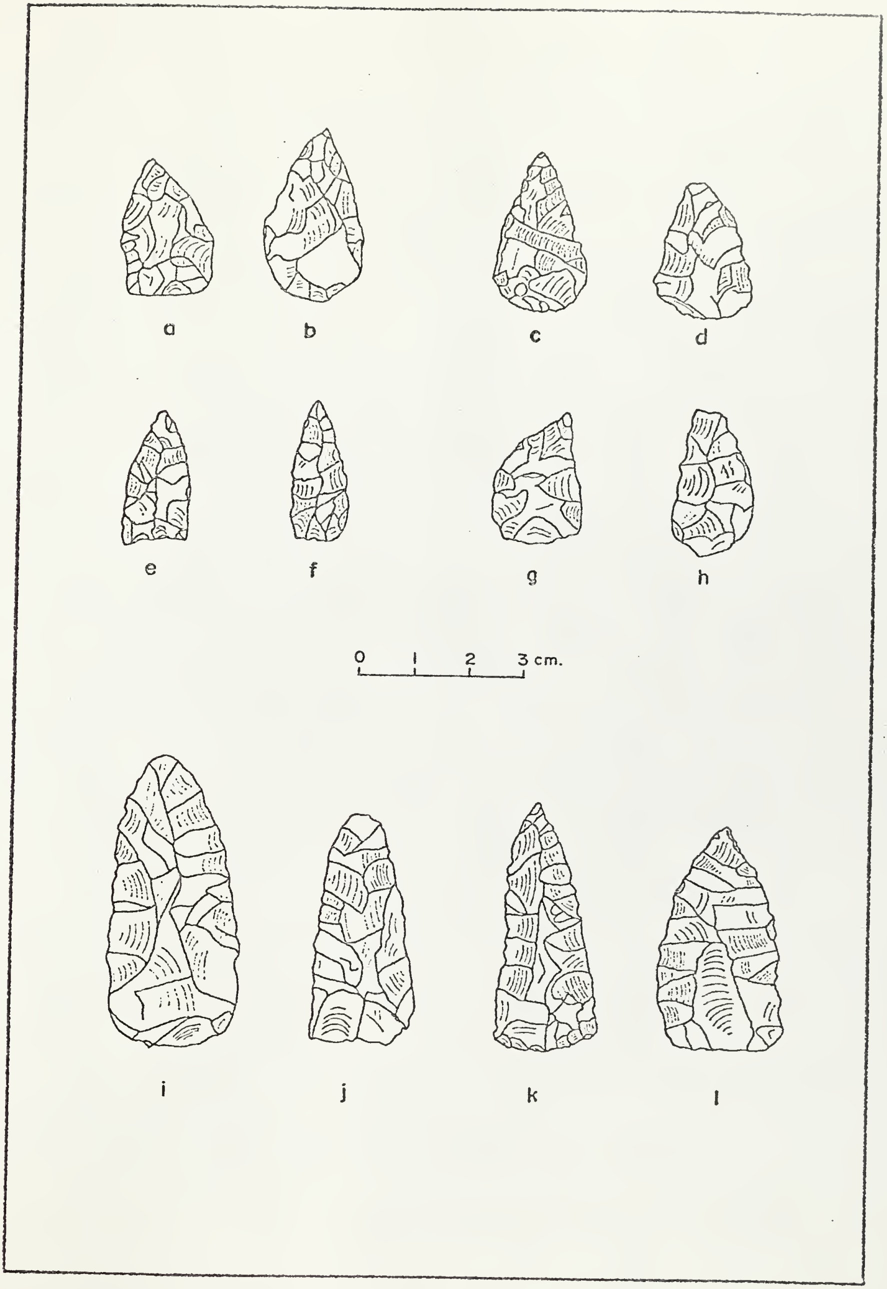
Figure 15

Chipped Stone Artifacts from the Thompson Collection.

Bifaces

Type I; a-h

Type II; i-l


a
b
c
d
e
f
g
h
0 1 2 3 cm.
i
j
k
l

A low medial ridge is apparent on one or both faces, formed by broad collateral flake scars, although random flaking is also present. These are probably the result of pressure flaking (Crabtree and Butler 1964).

Material: 2 chert, 2 jasper

Measurements: Length, 4.1 to 5.2 cm.; width, 1.9 to 2.3 cm.; thickness, 0.4 to 0.6 cm.; weight, 3.1 to 6.3 gm.

Comparable types: Leach (1970, Fig. 1, p-s).

Bifaces Type III (Fig. 16, a-b)

No. Specimens: 2

Description: These specimens are large, heavy bifaces, elongate ovoid in outline, and extensively flaked on both faces. They appear to have been worked down from large, thick flakes. One is assymetrical, with a narrow, concave base. The other has a thick, narrow oval base. Both have irregular cross-sections which vary from plano-convex to biconvex. Edges are slightly sinuous and irregular. Turned edges (beveling) are present along portions of the margins. Flake scars are generally random, although some parallel flaking is present. Numerous hinge and step fractures are present, producing thick areas on both faces. These bifaces are probably unfinished blanks.

Material: chalcedony

Measurements: Length, 6.1 to 7.5 cm. (not complete); width, 3.3 to 3.5 cm.; thickness, 0.7 to 1.0 cm.; weight, 18.1 to 24.0 gm.

Comparable types: none

Bifaces, Type IV (Fig. 16, c)

No. Specimens: 1

Description: This biface (probably a blank) was made on a curved blade. It has an elongate willow-leaf outline with pointed ends and a relatively

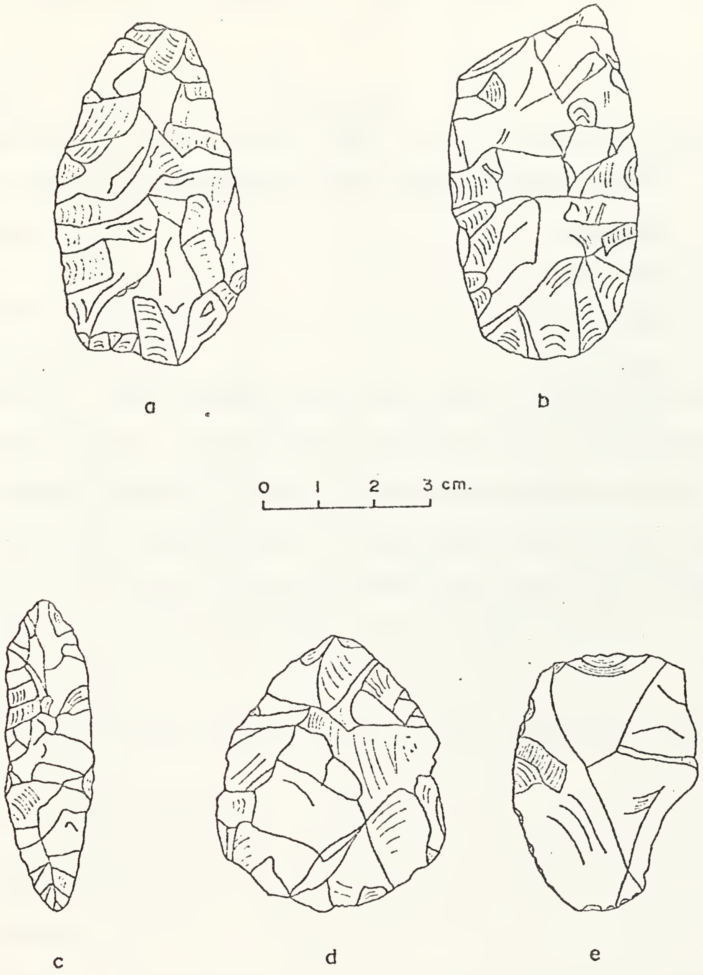

a
b
0 1 2 3 cm.
c
d
e

Figure 16

Chipped Stone Artifacts from the Thompson Collection.

Bifaces

Type III; a-b

Type IV; c

Type V; d

Type VI; e

thick biconvex cross-section. The bulb of force has not been completely removed. Both faces have been entirely flaked, but the dorsal surface is more extensively worked. Collateral flaking has produced a medial ridge along the midline of the ventral face. Lateral edges are sinuous and irregular.

Material: unknown

Measurements: Length, 5.5 cm.; width, 1.5 cm.; thickness, 0.6 cm.; weight, 5.7 gm.

Comparable types: none

Biface, Type V (Fig. 16, d)

No. Specimens: 1

Description: This specimen has an ovate outline with a wide obtuse point formed at one end. It is biconvex in cross-section. The edges are sinuous, formed by removal of relatively large flakes which converge at the center of each face. Negative bulbs of force are prominent on the flake scars. The biface appears to have been worked down from a core or thick flake. No original surface is present. It is probably a blank.

Material: chert?

Measurements: Length, 4.8 cm.; width, 4.1 cm.; thickness, 1.2 cm.; weight, 24.1 gm.

Comparable types: none

Bifaces, Type VI (Fig. 16, e)

No. Specimens: 1

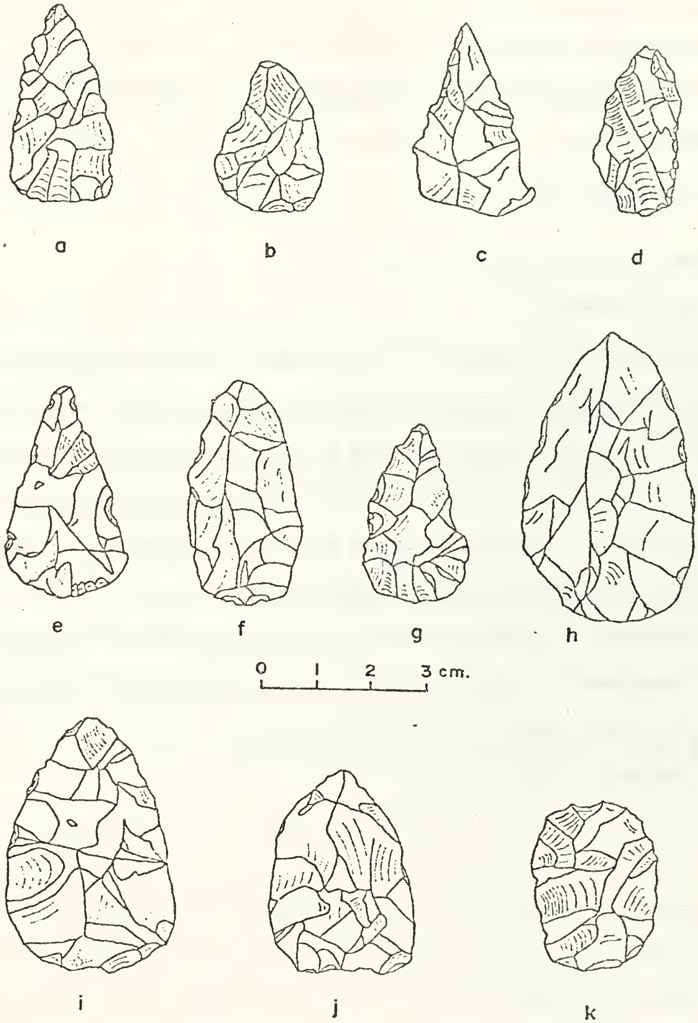
Description: The specimen was made on a medium-sized ovate flake and has one convex lateral edge which is bifacially retouched. This retouch is most extensive on the ventral face, and was done by pressure flaking.

Figure 17

Chipped Stone Artifacts from the Thompson Collection.

Bifaces

Type VII; a-k


a
b
c
d
e
f
g
h
0 1 2 3 cm.
i
j
k

The edge thus formed has a relatively acute edge angle. Small, short flakes, evidently removed by use, are present along this edge. The distal end of the flake, which is "nosed," shows signs of use on the dorsal face in the form of a polished bevel.

Material: chert ?

Measurements: Length, 4.7 cm.; width, 3.0 cm.; thickness, 0.9 cm.; weight, 11.6 gm.

Comparable types: none

Bifaces, Type VII (Fig. 17, a-k)

No. Specimens: 11

Description: Bifaces in this category exhibit a variety of shapes, but are generally ovate in outline with one pointed end. They tend to be smaller than those placed in Types II, III, V and VI. Cross-sections are relatively thick and uneven. Flake scars are large with prominant negative bulbs of force. Edges are sinuous with remnants of striking platforms still present. All specimens are probably blanks.

Material: 7 chert/chalcedony, silicified sedimentary stone; 3 unknown

Measurements: Length, 3.0 to 5.3 cm.; width, 1.4 to 3.1 cm.; thickness, 0.4 to 0.9 cm.; weight, 2.4 to 14.2 gm.

Comparable types: none

Artifacts Collected by the Antiquities Section

CHIPPED STONE

Chipped stone artifacts recovered by the Antiquities Section are divided into six categories: Points, Drills, Bifaces, Cores, Miscellaneous Flaked Cobbles, and Flakes. Appropriate subdivisions into type have been made where necessary. Type designations are the same as those defined for the Thompson Collection.

POINTS

Type I (Fig. 18, d)

No. Specimens: 1

Description: Small triangular point with excurvate edges. Side-notches are wide, shallow and poorly made. Flake scars are absent on both faces. Biconvex in cross-section.

Material: quartzite

Measurements: Length, 2.6 cm.; width, 1.2 cm.; thickness, 0.3 cm.; weight, 1.0 gms.

Provenience: 42Un405, 1 (Fig. 18, d)

Comparable Specimens: Thompson Collection (this report), Fig. 6, a-i.

Type II (Fig. 18, a-c)

No. Specimens: 3

Description: All are triangular in form with slightly excurvate edges. Side notches are shallow and rounded. All have a single notch at the mid-point of the base. The largest (Fig. 18, a) exhibits parallel oblique flaking on both faces. The flake scars terminate at the midline to form a

Figure 18

Chipped Stone Artifacts collected by the Antiquities Section.

Points

Type I; d (42Un405)

Type II; a (42Un365), b (42Un405), c (42Un376)

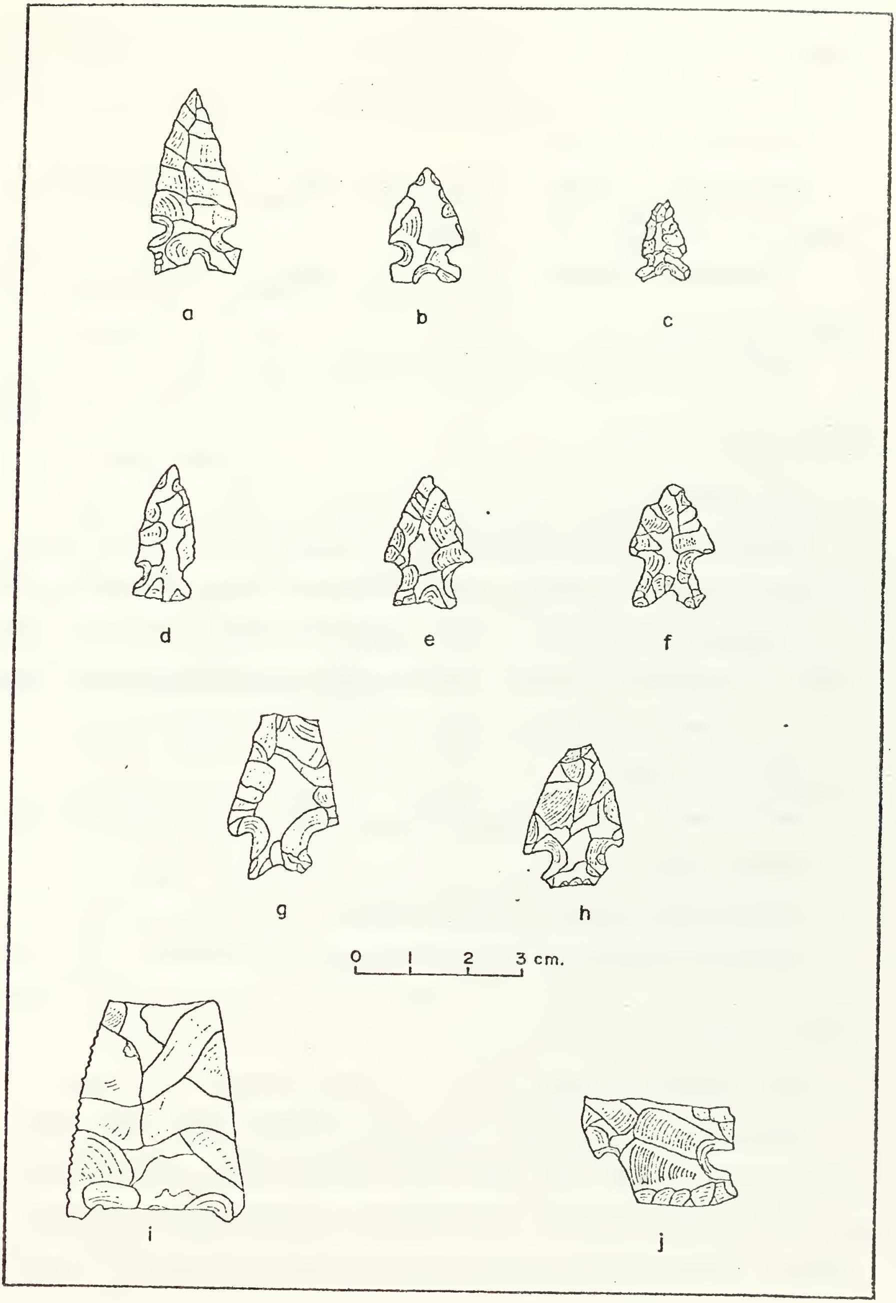
Type VI; g (42Un376)

Type VII; h (42Un367)

Type VIII; e (42Un370), f (42Un379)

Type XXV; i (42Un404)

Large Side-Notched; j (42Un380)


a
b
c
d
e
f
g
h
0 1 2 3 cm.
i
j

slight medial ridge. Flaking pattern on the two smaller specimens is random and poorly executed. All three are lenticular in cross-section.

Material: chert, quartzite

Measurements: Length, 1.1 to 3.4 cm.; width, 1.0 to 1.7 cm.; thickness, 0.3 cm.; weight, 0.3 to 0.9 gms.

Provenience: 42Un365, 1 (Fig. 18, a); 42Un376, 1 (Fig. 18, c); 42Un405, 1 (Fig. 18, b).

Comparable Specimens: Thompson Collection (this report), Fig. 6, j-n.

Type VI (Fig. 18, g)

No. Specimens: 1

Description: Large triangular point with straight edges. Stem is slightly expanding and basally thinned forming a shallow indentation. Tangs blunted by secondary retouch. Fairly regular collateral flaking at right angles to the edges. Specimen is plano-convex in cross-section and flake scars are absent on the central portion of the ventral face.

Material: chert

Measurements: Length (est.), 4.0 cm.; width, 2.1 cm.; thickness, 0.6 cm.; weight (est.), 4.0 gms.

Provenience: 42Un376, 1 (Fig. 18, g)

Comparable Specimens: Thompson Collection (this report), Fig. 8, a-d.

Type VII (Fig. 18, h)

No. Specimens: 1

Description: Triangular in form with excurvate edges. One corner notch is considerably deeper and broader than the other. Specimen is slightly curved and plano-convex in cross section. Flake scars are at right angles to the edges with the exception of a single thinning flake on the dorsal surface which runs from the base ca. two-thirds of the way to the tip. Ventral surface exhibits numerous step fractures.

Material: chert

Measurements: Length, 2.6 cm.; width, 1.9 cm.; thickness, 0.6 cm.; weight, 2.4 gms.

Provenience: 42Un367, 1 (Fig. 18, h)

Comparable Specimens: Thompson Collection (this report), Fig. 8, e-k.

Type VIII (Fig. 18, e and f)

No. Specimens: 2

Description: Small triangular points with straight edges. Tangs are at right angles to the midline. Both specimens display random flaking and numerous step fractures. One point (Fig. 18, e) has a slightly concave base formed by basal thinning. The other (Fig. 18, f) has a bifurcated base. Both are biconvex in cross section.

Material: chert

Measurements: Length, 2.3 to 2.4 cm.; width, 1.6 to 1.7 cm.; thickness, 0.4 to 0.5 cm.; weight, 1.2 to 1.4 gms.

Provenience: 42Un370, 1 (Fig. 18, e); 42Un379, 1 (Fig. 18, f)

Comparable Specimens: Thompson Collection (this report), Fig. 8, l-n.

Type XXV (Fig. 18, i)

No. Specimens: 1

Description: The base and tip of this specimen are missing. Large, thin triangular point, long in relation to width. Corner notches are shallow and directed at a slight angle toward the mid-line. Lenticular in cross section, broad, shallow parallel flake scars are visible on both faces. Flaking is collateral, forming a barely discernible medial ridge. Minute secondary retouch along one edge.

Material: chert

Measurements: Length (est.), 5.5 cm.; width, 3.2 cm.; thickness, 0.5 cm.

Provenience: 42Un404, 1 (Fig. 18, i)

Comparable Specimens: Thompson Collection (this report), Fig. 13, b-f.

Large Side-Notched (Fig. 18, j)

No. Specimens: 1

Description: Only a portion of the base was recovered and the original shape could not be determined. Side notches are narrow and directed at a slight angle toward the tip. Base is relatively straight and has been bifacially thinned. Plano-convex in cross section with broad, shallow collateral flake scars on both faces.

Material: jasper

Measurements: Width, 2.5 cm.; thickness, 0.5 cm.

Provenience: 42Un380, 1 (Fig. 18, j)

Comparable Specimens: Too fragmentary for comparison.

Point Fragments

No. Specimens: 4

Description: Three point tips and one base fragment. All are thin, probably triangular specimens. The base fragment displays shallow, rounded side notches, low on the lateral margins.

Material: chert, quartzite

Measurements: Thickness, 0.2 to 0.4 cm. The single base fragment is 0.3 cm. thick and 1.9 cm. wide.

Provenience: 42Un355, 1 (base); 42Un367, 1; 42Un375, 1; 42Un377, 1.

Comparable Specimens: Too fragmentary for comparison.

DRILL (Fig. 19, a)

No. Specimens: 1

Description: The base is roughly oval in shape. The blade of the drill tapers gradually to a blunted point. The blade is steeply retouched and biconvex in cross section.

Material: chert

Measurements: Length, 3.2 cm.; width of base, 1.2 cm.; width of blade, 0.6 cm.; thickness, 0.4 cm.; weight, 1.3 gms.

Provenience: 42Un405, 1 (Fig. 19, a)

Comparable Specimens: Thompson Collection (this report), Fig. 14, b.

BIFACES

Type II: Complete Specimens (Fig. 19, b and c)

No. Specimens: 2

Description: Both specimens are roughly triangular in shape with excurvate edges and a convex base. One (Fig. 19, b) is thin and lenticular in cross section. Both faces display broad shallow flake scars, many of which terminate in step fractures along the mid-line. Edges are sinuous and irregular. The other (Fig. 19, c) is plano-convex in cross section and relatively thick. Both faces have deep, rounded flake scars with prominant negative bulbs of force. Numerous scars terminate in step fractures.

Material: chert, chalcedony

Measurements: Length, 6.4 cm.; width, 3.2 to 4.2 cm.; thickness, 0.6 to 1.5 cm.; weight, 14.2 to 46.5 gms.

Provenience: 42Un366, 1 (Fig. 19, b); 42Un378, 1 (Fig. 19, c).

Comparable Specimens: Thompson Collection (this report), Fig. 16, i-l.

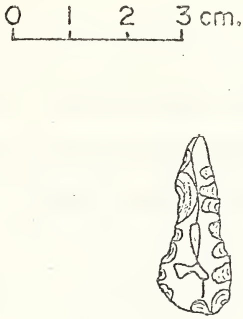
Figure 19

Chipped Stone Artifacts Collected by the Antiquities Section.

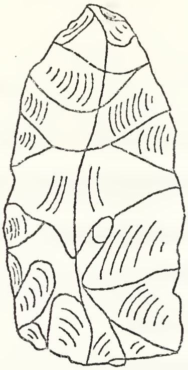
Drill; a

Type II Bifaces; b and c

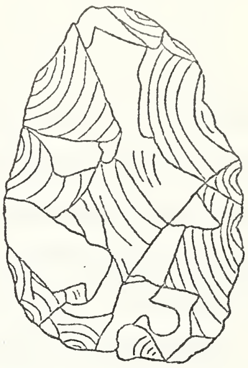
Cores; d and e



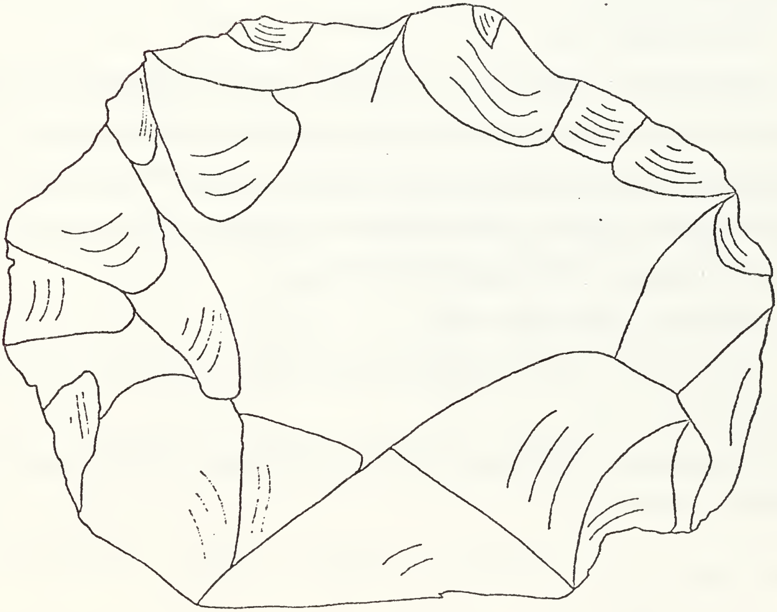
a



b



c



d

Type II: Fragments

No. Specimens: 14

Description: Mid-sections, tips and bases of broken, bifacially worked implements. Fragments are too small to determine original shape. Flake scars vary from broad and shallow to broad and deep with prominant bulbs of force. Several specimens show definite evidence of heat treatment in the form of surface color and luster differences.

Material: chert, chalcedony

Measurements: Thickness varies from 0.5 to 1.6 cm.

Provenience: 42Un367, 1; 42Un369, 2; 42Un370, 2; 42Un372, 1; 42Un375, 1; 42Un377, 1; 42Un401, 1; 42Un405, 2; 42Un407, 1; 42Un409, 2.

Large Thick Bifaces

No. Specimens: 9

Description: Relatively thick cobbles, bifacially flaked on all edges. Scars are broad and deep and show moderate negative bulbs of force. Numerous flake scars terminate in deep step fractures. Five specimens retain a portion of the original cortex. These specimens are probably reject preforms. All material have poor flaking characteristics.

Material: chert, quartzite

Measurements: Length, 7.0 to 12.0 cm.; width, 3.8 to 6.6 cm.; thickness, 2.1 to 3.5 cm.

Provenience: 42Un367, 1; 42Un368, 1; 42Un370, 1; 42Un374, 1; 42Un401, 1; 42Un402, 3; 42Un406, 1.

CORES (Fig. 19, d)

No. Specimens: 2

Description: One specimen (Fig. 19, d) is a large ovoid cobble, biconvex in cross section. Flakes have been removed bifacially (probably by percussion) around the entire circumference. Flake scars show prominant negative bulbs of force and average 5.0 cm. in length by 4.0 cm. in width. The other is rectanguloid in form. Four parallel flake scars appear at one end. They have prominant negative bulbs of force and average 3.5 cm. in length by 2.0 cm. in width. Flakes were struck from a prepared striking platform on the obverse face.

Material: quartzite

Measurements: (Ovoid example) Length, 14.5 cm.; width, 11.5 cm.; thickness, 6.5 cm. (Rectanguloid example) Length, 11.0 cm.; width, 7.5 cm.; thickness, 4.0 cm.

Provenience: 42Un367, 1; 42Un402, 1 (Fig. 19, d).

MISCELLANEOUS FLAKED COBBLES

No. Specimens: 5

Description: Amorphous cobbles with six to eight flakes randomly removed. No pattern discernable. These specimens probably represent "shatter" (Binford and Quimby 1961): lithic debris resultant from aboriginal testing for flaking quality. All examples are of poor quality material and were apparently rejected without further modification.

Material: quartzite

Measurements: Length, 9.0 to 11.0 cm.; width, 5.5 to 9.0 cm.; thickness, 2.5 to 7.0 cm.

Provenience: 42Un367, 2; 42Un402, 2; 42Un406, 1.

FLAKES

Decortication

No. Specimens: 16

Description: Plano-convex flakes with cortex remaining on the dorsal surface. All have prominent bulbs of force on the ventral surface and well developed striking platforms. These specimens are probably decortication flakes from the initial stages of tool manufacture.

Material: chert, quartzite

Measurements: Length, 3.3 to 11.3 cm.; width, 2.3 to 7.9 cm.; thickness, 0.5 to 2.3 cm.

Provenience: 42Un355, 1; 42Un367, 1; 42Un370, 1; 42Un372, 2; 42Un375, 2; 42Un377, 2; 42Un402, 6; 42Un405, 1.

Small Unmodified

No. Specimens: 205

Description: Unmodified lithic debitage.

Material: chert, quartzite

Provenience: 42Un355, 3; 42Un366, 5; 42Un367, 16; 42Un368, 3; 42Un369, 20; 42Un370, 17; 42Un371, 1; 42Un372, 13; 42Un373, 2; 42Un374, 1; 42Un375, 10; 42Un376, 3; 42Un377, 32; 42Un378, 6; 42Un379, 8; 42Un301, 7; 42Un402, 21; 42Un405, 27; 42Un407, 1; 42Un409, 9.

GROUND STONE

Only three examples of ground stone were recovered: a metate and mano fragment and a portion of a steatite pipe.

METATE

No. Specimens: 1

Description: Fragment of shallow troughed metate. Exterior surface unworked. Trough pecked and ground. Upper portion of lateral lip crudely shaped by pecking and not ground. Specimen decreases in thickness from the lateral edge to the center of the trough.

Material: sandstone

Measurements: Maximum thickness (lateral edge), 3.5 cm.; minimum thickness (center of trough), 2.1 cm.

Provenience: 42Un401

MANO

No. Specimens: 1

Description: Fragment of a unifacial mano. Use surface pecked and ground. Edged shaped to subrectangular form by pecking.

Material: coarse red sandstone with quartzite inclusions

Measurements: Width, 7.2 cm.; thickness, 3.8 cm.

Provenience: 42Un401

PIPE

No. Specimens: 1

Description: Tubular stone pipe fragment. Black in color. Exterior highly polished; interior scored and unpolished. The rim of the bowl is tapered, rounded and considerably thinner than the body. The "mouthpiece" is broken off.

Material: steatite

Measurements: Maximum thickness (body), 0.5 cm.; minimum thickness (bowl rim), 0.2 cm.; bowl diameter (est.), 2.0 cm.

Provenience: 42Un405

Comparable Specimens: Leach (1970, Plate 19 a-b); Steward (1936).

HAMMERSTONES

No. Specimens: 4

Description: Two of the specimens are quartzite river cobbles. One is oval in shape and battered on the polar ends. The other is a broken end of a flat, subrectangular form and is battered along the edges. The third specimen is a conglomerate river cobble battered on one end only. The fourth specimen is an amorphous piece of poor quality chert.

Measurements: (Ovoid forms) Length, 5.4 to 6.6 cm.; width, 5.0 to 5.6 cm.; thickness, 3.4 to 5.4 cm. (Subrectangular fragment) Width, 8.8 cm.; thickness, 2.6 cm.

Provenience: 42Un370, 1; 42Un401, 1; 42Un405, 1; 42Un409, 1

ETCHED STONE TABLET (Fig. 20)

No. Specimens: 1

Description: Flat tabular stone. Roughly triangular in outline with rounded corners. The decorated side was first ground smooth and design elements executed by incision. The obverse side is an unmodified weathered surface. Design elements consist of zig-zag lines and abstract figures shaded with parallel lines and cross-hatching. Elements at the upper (?) portion of the tablet (Fig. 20) are obliterated by lichen growth.

Material: shaley sandstone

Measurements: Length, 16.5 cm.; maximum width (base), 16.0 cm.; thickness, 1.0 cm.

Provenience: 42Un371

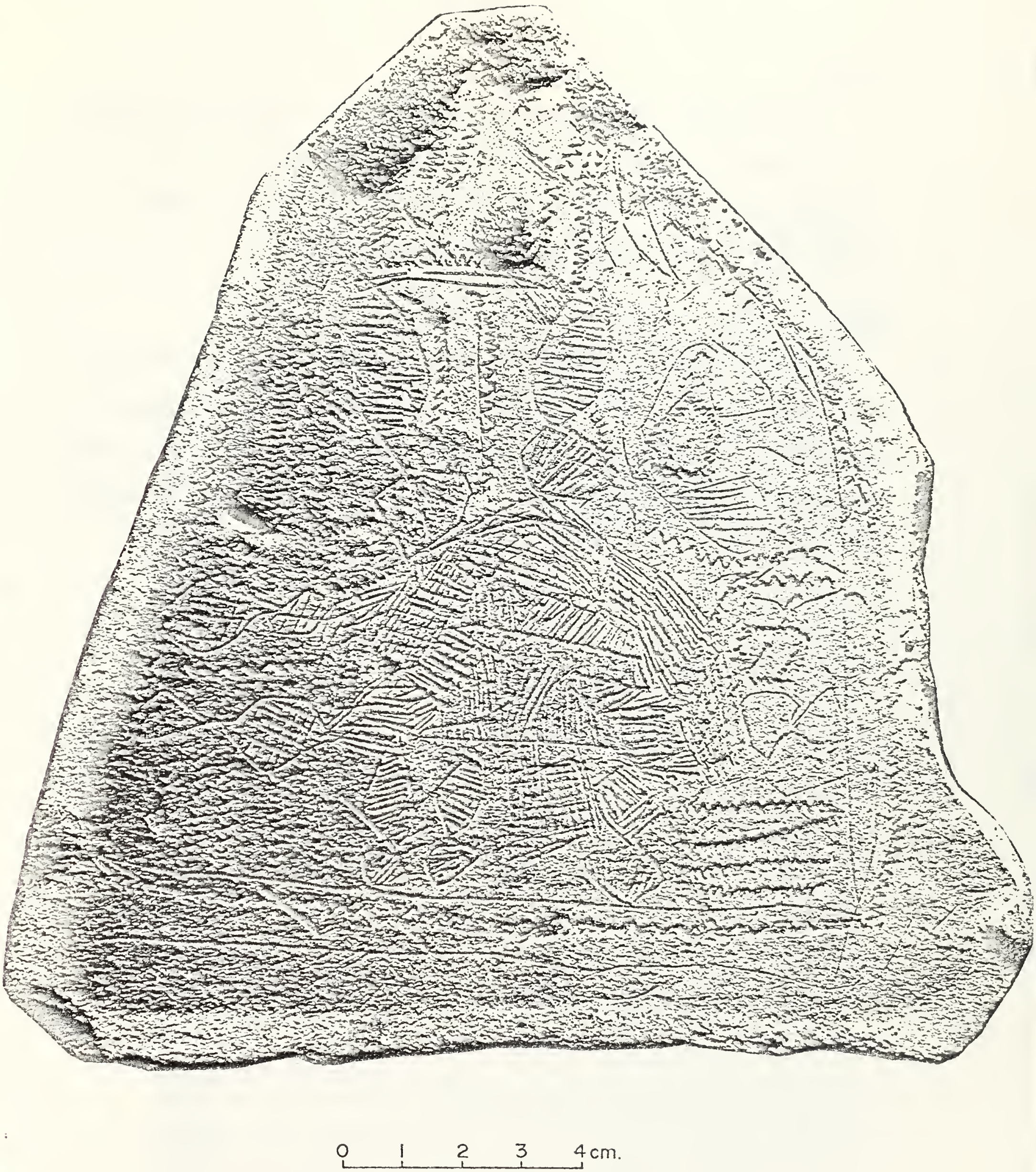


Figure 20. Etched Slate Tablet (42Un371).

POTTERY

Thirteen sherds were recovered from the Ignatio Stage Stop (42Un401). All are Tusayan Corrugated. Their occurence in the Bonanza area is anaomalous and it is possible that they were brought into the region in historic times. (see Conclusions and Recommendations)

MAIZE

The only perishables recovered during investigations were three corn cobs from Wagon Hound Alcove (42Un118). Two of the specimens are eight-rowed and the third is ten-rowed. They are all small or immature, ranging from 6.5 to 7.4 cm. in length and 1.2 to 1.7 cm. in diameter. No kernals were found intact.

TABLE I

Distribution of Artifacts at White River Archeological Sites.

	Type I Points	Type II Points	Type VI Points	Type VII Points	Type VIII Points	Type XXV Points	Large Side-Notched Points	Point Fragments	Drill	Bifaces (Type II) & Frags.	Large Thick Bifaces	Cores	Misc. Flaked Cobbles	Decortication Flakes	Small Unmodified Flakes	Metate	Manos	Stone Pipe	Hammerstones	Etched Stone Tablet	Pottery	Maize
ROCKSHELTERS																						
42Un118																						3
42Un324																						
42Un355								1						1	3							
42Un365		1																				
42Un366										1					5							
42Un367				1				1		1	1	1	1	1	16							
42Un381																						
42Un402											3	1	2	6	21							
42Un404						1																
42Un407										1					1							
42Un409										2					9				1			
OPEN SITES																						
42Un356																						
42Un357																						
42Un358																						
42Un368											1				3							
42Un369										2					20							
42Un370					1					2	1			1	17				1			
42Un371															1					1		
42Un372										1				2	13							
42Un373															2							
42Un374											1				1							
42Un375								1		1				2	10							
42Un376		1	1												3							
42Un377								1		1				2	32							
42Un378										1					6							
42Un379					1										5							
42Un380							1															
42Un401										1	1				7	1	1		1		13	
42Un405	1	1							1	2				1	27			1	1			
42Un406											1		1									
42Un408																						

CONCLUSIONS AND RECOMMENDATIONS

Little may be inferred from the paltry collection of artifacts recovered by the Antiquities Section. In many ways the Thompson collection is considerably more illuminating. Unfortunately, this site was excavated without stratigraphic controls and the consequent information falls considerably short of the obvious data potential. Nonetheless, we are indebted to Mr. Thompson for allowing us to analyze the materials and for directing us to several significant sites on the periphery of the investigation area that would have otherwise remained unrecorded.

The Thompson collection (site 42Un377) unequivocally establishes the presence of Archaic hunter-gatherers in the area. The presence of McKean points suggests that initial occupation of the oil-shale lands occurred between 4800 and 3300 B.P. Subsistence activities apparently centered around hunting as indicated by the charred bone refuse unearthed at the site. The virtual absence of milling stones at 42Un377 and, for that matter, at most of the recorded sites, suggests that floral resources were not extensively exploited at the riverine encampments.

Cultural affiliation of the remainder of the sites is difficult to assess. The small point series (Types I, II, III, IV, V, and VIII) from sites 42Un365, 42Un367, 42Un370, 42Un376, 42Un377, 42Un379 and 42Un405 indicates the use of bow and arrow. The corner-notched varieties (Types IV, V, and VIII) are similar to types associated with northwest Plains hunter-gatherers (Kehoe 1966), eastern Plains agriculturalists (Johnson 1974), the Uncompahgre Complex (Wormington and Lister 1956), Pueblo I in the Anasazi area (Brew 1946), and various Fremont complexes (Marwitt 1970). This indicates a temporal range of 1450 to 850 B.P. The side-notched types (Types I, II, and III) replaced the corner-notched points on the northwest Plains (Kehoe 1966) and are associated with Pueblo II and III complexes in the Anasazi area (Morris 1939; Brew 1946). Their distribution in the Fremont area is restricted to the Great Salt Lake and Uinta variants. Temporal range in the study area is probably 1000 to 650 B.P. Of these various cultures, only the northwest Plains and Uncompahgre were aceramic. The absence of pottery at sites yielding the small points thus suggests Plains or Uncompahgre affiliation. The only evidence of Anasazi cultures in the study area is the Tusayan Corrugated pottery recovered from the Ignacio Stage Stop (42Un401). Mesa Verde ceramics have been reported by Breternitz (1970) at Dinosaur National Monument, but this is the first reported occurrence of Kayenta series ceramics in the Uinta Basin. Breternitz interprets the Mesa Verdean ceramics as "trade ware" rather than an indication of Anasazi occupance. The same interpretation is probably appropriate here though it is also possible that the Kayenta sherds were transported to the site by White travelers in historic times.

Sites 42Un118 and 42Un366 are potentially relevant to the Basketmaker II hypothesis offered earlier. The Basketmaker II level of technology is defined by the absence of ceramics, use of atlatl, and the cultivation of maize. 42Un118 has yielded numerous corn cobs but no pottery. No pottery was recovered from 42Un366 and the red ochre pictographs are quite similar to those associated with Basketmaker II sites in northeastern Arizona. Neither site yielded diagnostic lithic material. The Basketmaker II assignation is admittedly conjectural and controlled excavation will be required to support or refute this claim.

No definite evidence of Fremont occupance was found in the survey area. The only examples of Uinta Gray pottery were found in Cowboy Canyon ca. 3.0 miles east of the buffer zone boundary. This indicates that, contrary to published opinion, Fremont agriculturalists may not have been the predominant cultural entity in the Uinta Basin during the late (post 1500 B.P.) prehistoric period. The same conclusion is suggested by the Dinosaur National Monument data (Breternitz 1970) since only ca. 5 percent of the sites contained Fremont pottery types.

In sum, cultures represented in the oil-shale lands include Archaic and late prehistoric hunter-gatherers and, possibly, groups who functioned on a Basketmaker II level of technology. In the context of currently acceptable definitions, there is no evidence of Fremont occupance.

Recommendations

Potentially significant archeological sites on the oil-shale tracts have already suffered serious damage at the hands of local residents. The planned population influx entailed by proposed oil-shale development will very likely result in the total destruction of the sites. Hence, the normal recommendation of stratigraphic tests and partial excavation must be replaced by a recommendation that the sites be fully excavated when tests indicate more than a surface artifact scatter. Partial excavation by professionals only serves to attract the attention of vandals and, in many cases, facilitates their endeavors. One need only review the Hogup Cave (Aikens 1970) or Signal Butte (Strong 1935) monographs to predict the fate of partially excavated sites in the oil-shale area.

The rockshelters have been vandalized to a greater extent than the open sites. All rockshelters that contain remnants of undisturbed deposits (118, 365, 366, 367, 381, 402, 404, and 407) should be completely excavated as soon as the services of professional agencies with adequately trained personnel can be obtained. With the exception of 42Un377 (reported herein), the open sites have not been disturbed beyond intensive surface collection. Most of these sites appear to be surface only, but judging from the Thompson collection, many are potentially very productive. All open sites (356, 357, 358, 368, 369, 370, 371, 372, 373, 374, 375, 376, 378, 379, 380, 401, 405, 306, and 408) should be tested and those that show evidence of stratified deposits should be fully excavated.

The above recommendations are based on the hypothesized impact of population influx in the study area. It would be naive to assume that this impact will be limited to the oil-shale lands and the arbitrary one-mile buffer zone. A long term survey and monitoring program within at least a 50 mile radius of the lease lands should be initiated as soon as possible. This would entail a systematic survey of the area and periodic checking of major sites for evidence of vandalism. If this monitoring program demonstrates a marked increase in vandalism subsequent to the population influx, the responsible corporations should provide funds for emergency excavation by professionally qualified institutions. It is imperative that this survey and monitoring program be initiated prior to economic development if the impact of that development is to be properly evaluated.

One further point bears mentioning. The Division of Water Resources, State of Utah, has proposed construction of a reservoir on the White River in the approximate center of Section 17, Township 10 South, Range 24 East. The construction itself will destroy sites 42Un377 and 42Un379, and the proposed pool level of 5010 (Rees Madsen, personal communcation) will inundate river terrace sites 42Un356, 357, 358, 368, 369, 370, 371, 372, 373, 374, 375, 376, and 378. Excavation of these sites is assured under the Reservoir Salvage Acts of 1960 and 1974.

National Register Nomination

The National Historic Preservation Act of 1966 authorizes the Secretary of the Interior to expand and maintain the National Register of Historic Places. The criteria applied to evaluate properties for possible inclusion in the National Register include the following, which are pertinent to archeological sites: properties "that have yielded, or may be likely to yield, information important in pre-history or history;" and properties "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction."

Within this context, no archeological sites located by this survey will be nominated to the National Register at this time. Of prime consideration is the fact that while the sites as a group are expected to yield information important to our understanding of Uinta Basin prehistory, their destruction would automatically remove them from National Register status as soon as all scientific data were extracted from them. Thus, it would be an unnecessary step to place sites on the Register. One historic site, however, the Ignacio Stage Stop, has been nominated to the National Register by the Bureau of Land Management.

APPENDIX I

A Compilation of All Reported Sites In and Adjacent to Uinta Basin Oil Shale Tracts U-a and U-b.

NOT FOR PUBLIC USE. COPIES WILL BE AVAILABLE FOR PROFESSIONAL USE AT THE UTAH HISTORICAL SOCIETY AND THE BUREAU OF LAND MANAGEMENT.

Site No: 42Un118
Map Reference: Southam Canyon Quad, USGS
Location: NE¼, NW¼, Sec. 2, T10S, R24E, "0.3 mi. north of White River bridge on U-45; on north side of road."
Type Site: Rockshelter
Material Collected: three corn cobs
Material Reported: flint chips, corn cobs, burned bone, mat fragments
Cultural Affiliation:

Site No: 42Un324
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, NE¼, Sec. 23, T10S, R24E, "2.5 mi. E of Southam Canyon; 1 mi. W of Evacuation Creek; 1¼ mi. SE of White River."
Type Site: Rockshelter
Material Collected: none
Material Reported: scattered chips, partial projectile point, bone and charcoal
Cultural Affiliation:

Site No: 42Un355
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NW¼, Sec. 12, T10S, R24E, "200 ft. S of road at 0.8 mi. No. of benchmark."
Type Site: Rockshelter
Material Collected: (1) point fragment; (1) flake Type I, (3) flakes Type II
Cultural Affiliation:

Site No: 42Un356
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, SW¼, Sec. 16, T10S, R24E, "Where three tributary arroyos intersect the White River; site lies between the two western most of the three arroyos; ca. 250 m. N of present river course."
Type Site: Open
Material Collected: none
Cultural Affiliation:

Site No: 42Un357
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, SW¼, Sec. 16, T10S, R24E, "Ca. 6½ mi. SW of Bonanza where 3 tributary arroyos intersect the White River; ca. 150 m. N of the present river course."
Type Site: Open
Material Collected: destroyed in fire 7-27-74
Cultural Affiliation:

Site No: 42Un358
Map Reference: Southam Canyon Quad, USGS
Location: Center of SW¼, Sec. 16, T10S, R24E, "Ca. 6½ mi. SW of Bonanza, Utah where 3 tributary arroyos intersect the White River."
Type Site: Open
Material Collected: none
Cultural Affiliation:

Site No: 42Un365
Map Reference: Asphalt Wash Quad, USGS
Location: SE¼, SW¼, Sec. 6, T11S, R24E, "Mouth of Hanging Rock Hollow; ca. 300 m. N of confluence of center & west forks of Asphalt Wash."
Type Site: Rockshelter
Material Collected: (1) point Type II
Cultural Affiliation:

Site No: 42Un366
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, SE¼, SEc. 2, T10S, R24E, "Site is ca. ½ mi. S of White River bridge on Bonanza to Dragon road; in 1st arroyo S of bridge."
Type Site: Rockshelter; Pictograph
Material Collected: Points: (1) Biface Type I; Flakes: (5) Type II
Cultural Affiliation:

Site No: 42Un367
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, SE¼, Sec. 2, T10S, R24E, "Site is ca. ¼ mi. S of White River; 50 yds. S of Bonanza to Dragon road."
Type Site: Rockshelter
Material Collected: Points: (1) Type VII, (1) Point Fragment; (1) Biface Type I; (1) Biface Type II; (1) Core; (1) Misc. Flaked Cobble; (1) Flake Type I, (16) Flakes Type II
Cultural Affiliation:

Site No: 42Un368
Map Reference: Southam Canyon Quad, USGS
Location: SW¼, SE¼, Sec. 11, T10S, R24E, "Site located 100 yds E of White River, directly S of river access road. Ca. 1½ mi. from Bonanza to Dragon road; site bordered by sheer cliff on W."
Type Site: Open
Material Collected: Points: (1) Biface Type II; (3) Flakes Type II
Cultural Affiliation:

Site No: 42Un369
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, SE¼, Sec. 11, T10S, R24E, "Ca. 1½ mi. S of Ignacio stage stop on E bank of White River; on a pleistocene terrace."
Type Site: Open
Material Collected: Points: (2) Bifaces Type I; (20) Flakes Type II
Cultural Affiliation:

Site No: 42Un370
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, SW¼, Sec. 11, T10S, R24E, "Site ca. 1½ mi. S of White River bridge on E bank of White River. On pleistocene terrace 40 ft. above river banks."
Type Site: Open
Material Collected: Points: (1) Type VIII, (2) Bifaces Type I, (1) Biface Type II; (1) Flake Type I, (17) Flakes Type II; (1) Hammerstone
Cultural Affiliation:

Site No: 42Un371
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, SW¼, Sec. 11, T10S, R24E, "Site 1½ mi. S of White River bridge on E bank of White River; on pleistocene terrace 100 ft. east of river, bordered on N by narrow wash."
Type Site: Open; Pictograph
Material Collected: (1) Flake Type II; (1) Etched stone tablet
Cultural Affiliation:

Site No: 42Un372
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NW¼, Sec. 14, T10S, R24E, "On knoll on S bank of White River."
Type Site: Open
Material Collected: Points: (1) Biface Type I; (2) Flakes Type I, (13) Flakes Type II
Cultural Affiliation:

Site No: 42Un373
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NW¼, Sec. 14, T10S, R24E, "On knoll overlooking S bank of White River."
Type Site: Open
Material Collected: (2) Flakes Type II
Cultural Affiliation:

Site No: 42Un374
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, NE¼, Sec. 15, T10S, R24E, "On knoll overlooking south bank of the White River."
Type Site: Open
Material Collected: (1) Biface Type II; (1) Flake Type II
Cultural Affiliation:

Site No: 42Un375
Map Reference: Southam Canyon Quad, USGS
Location: Center NE¼, Sec. 15, T10S, R24E, "On knoll between two dry arroyos, overlooking flat on south bank of the White River."
Type Site: Open
Material Collected: (1) Point fragment; (1) Biface Type I; (2) Flakes Type I, (10) Flakes Type II
Cultural Affiliation:

Site No: 42Un376
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NW¼, Sec. 7, T10S, R25E, "On S bank of White River, ca. 200 m. W of confluence of White River and Evacuation Creek."
Type Site: Open
Material Collected: Points: (1) Type II, (1) Type VI; (3) Flakes Type II
Cultural Affiliation:

Site No: 42Un377
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, NE¼, Sec. 7, T10S, R24E, "Site bounded by two sandstone boulders, 500 yds. N of present course of White River. Site directly N of log structure in Wetts Canyon."
Type Site: Open
Material Collected: (1) Point fragment; (1) Biface Type I; (2) Flakes Type I, (32) Flakes Type II
Cultural Affiliation:

Site No: 42Un378
Map Reference: Southam Canyon Quad, USGS
Location: NE¼, SE¼, Sec. 17, T10S, R24E, "On N bank of White River on terrace remnant adjacent to the S side of wash road from Wagon Hound Canyon."
Type Site: Open
Material Collected: (1) Biface Type I; (6) Flakes Type II
Cultural Affiliation:

Site No: 42Un379
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, SE¼, Sec. 17, T10S, R24E, " On knoll overlooking S bank of White River at confluence of a major arroyo heading in Southam Canyon and the White River."
Type Site: Open
Material Collected: Points: (1) Type VIII; (8) Flakes Type II
Cultural Affiliation:

Site No: 42Un380
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NW¼, Sec. 1, T10S, R24E, 'N bank of White River ca. ¼ mi. E of White River Bridge."
Type Site: Open
Material Collected: Points: (1) Large Side-Notched
Cultural Affiliation:

Site No: 42Un381
Map Reference: Southam Canyon Quad, USGS
Location: NE¼, NW½, Sec. 1, T10S, R24E, "Site located ca. 1/3 mi. NE from White River; ca. 1 mi. from White River Bridge."
Type Site: Rockshelter
Material Collected: none
Cultural Affiliation:

Site No: 42Un401
Map Reference: Southam Canyon Quad, USGS
Location: NE¼, SE¼, Sec. 2, T10S, R24E, "Site ca. 50 m. E of Utah Hwy. 45, on S side of White River. Remaining buildings of Ignatio Stage Stop overlay western portion of site."
Type Site: Open
Material Collected: (1) Biface Type I, (1) Biface Type II; (7) Flakes Type II; (1) Metate; (1) Mano; (1) Hammerstone; (13) Pot sherds
Cultural Affiliation:

Site No: 42Un402
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, SE¼, Sec. 16, T10S, R24E, "Site faces south, on N side of White River on high bluff, in saddle."
Type Site: Cave; Rockshelter
Material Collected: (3) Bifaces Type II; (1) Core; (2) Misc. Flaked Cobbles; (6) Flakes Type I, (21) Flakes Type II
Cultural Affiliation:

Site No: 42Un403
Map Reference: Rainbow Quad, USGS
Location: SE¼, SE¼, Sec. 23, T11S, R24E, "Ten ft. off N side of road cut on sandstone cliff facing south; 10 ft. below crest of cliff."
Type Site: Pictograph
Material Collected: not applicable
Cultural Affiliation:

Site No: 42Un404
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, SW¼, Sec. 16, T10S, R24E, "South of dirt road just N of White River; shelter faces west on N bank of river."
Type Site: Rockshelter
Material Collected: Points: (1) Type XXV
Cultural Affiliation:

Site No: 42Un405
Map Reference: Southam Canyon Quad, USGS
Location: W½, SE¼, Sec. 9, T10S, R24E, "In Wetts Canyon ca. 1½ mi. N of White River. On butte ca. 300 m. E of Wetts Canyon road."
Type Site: Open
Material Collected: Points: (1) Type II, (1) Type I; (1) Drill; (2) Bifaces Type I; (1) Flake Type I; (27) Flakes Type II; (1) Stone pipe; (1) Hammerstone
Cultural Affiliation:

Site No: 42Un406
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NE¼, Sec. 20, T10S, R24E, "On 2 adjacent, low, flat knolls in Southam Canyon; ca. ¼ mi. SW of White River and ca. 6 mi. SW of Bonanza."
Type Site: Open

Material Collected: (1) Biface Type II; (1) Misc. Flaked Cobble
Cultural Affiliation:

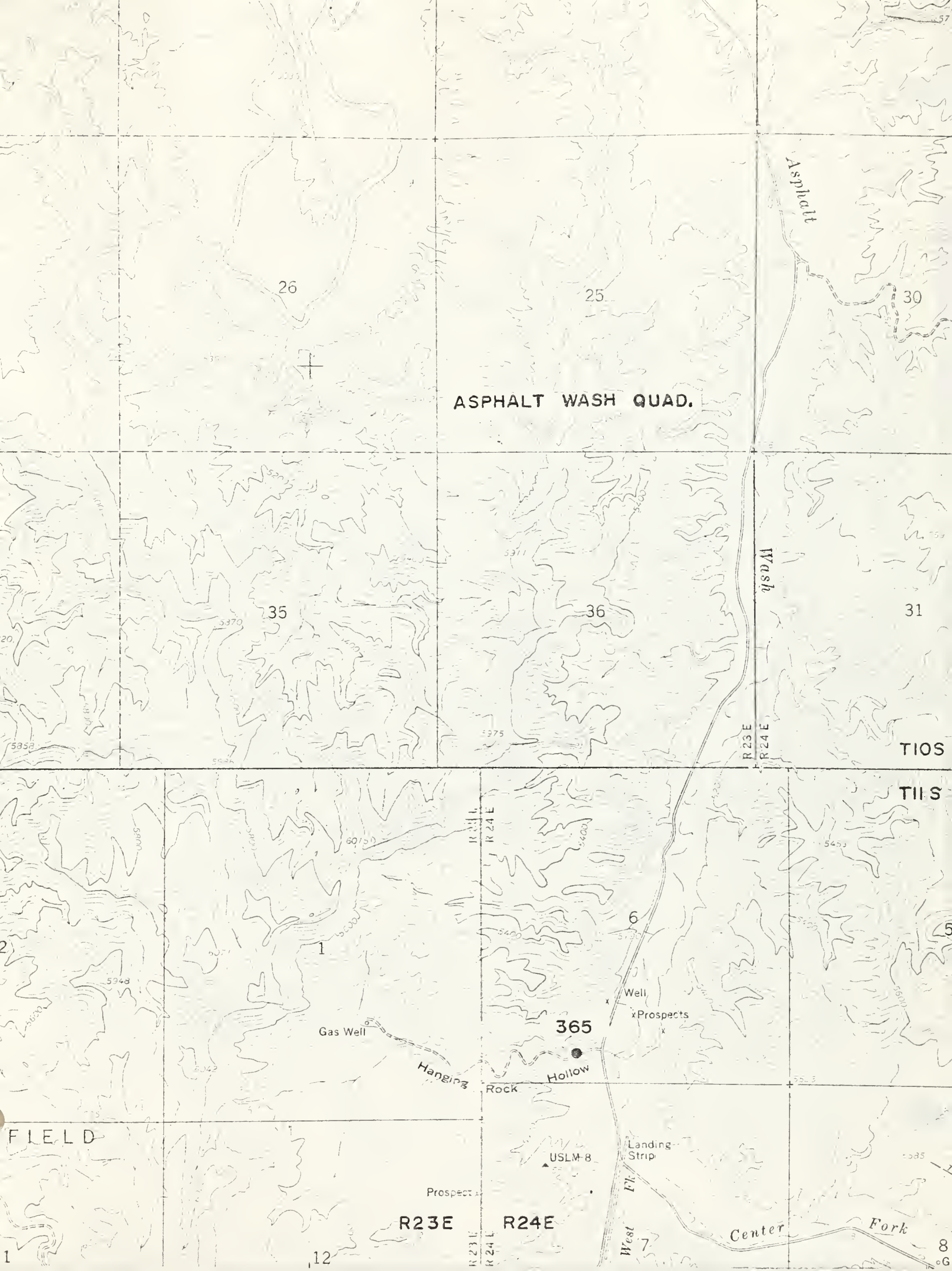
Site No: 42Un407
Map Reference: Southam Canyon Quad, USGS
Location: NW¼, NE¼, Sec. 22, T10S, R24E, "From White River Bridge go S for ca. 2 mi. to fork; take right fork for ca. 3 mi. and turn right on dirt road; follow for 1½ mi. Site on right side of road."
Type Site: Rockshelter
Material Collected: (1) Biface Type I; (1) Flake Type II
Cultural Affiliation:

Site No: 42Un408
Map Reference: Southam Canyon Quad, USGS
Location: SE¼, NE¼, SE¼, Sec. 23, T10S, R24E, "On road to Southam Canyon, ca. 3½ mi. SW of U-45; ca. 2 mi. SE of White River and ca. 1 mi. W of Evacuation Creek."
Type Site: Open
Material Collected: none
Cultural Affiliation:

Site No: 42Un409
Map Reference: Southam Canyon Quad, USGS
Location: On Sec. line dividing Secs. 23 & 24; Center of Sec. 23, T10S, R24E, "Ca. 5 m. W of jeep trail; in sandstone outcrop ca. ½ mi. from Evacuation Wash."
Type Site: Rockshelter
Material Collected: (2) Bifaces Type I; (9) Flakes Type II; (1) Hammerstone
Cultural Affiliation:

APPENDIX II

Completed Site Survey Forms
with Attached Maps and Photographs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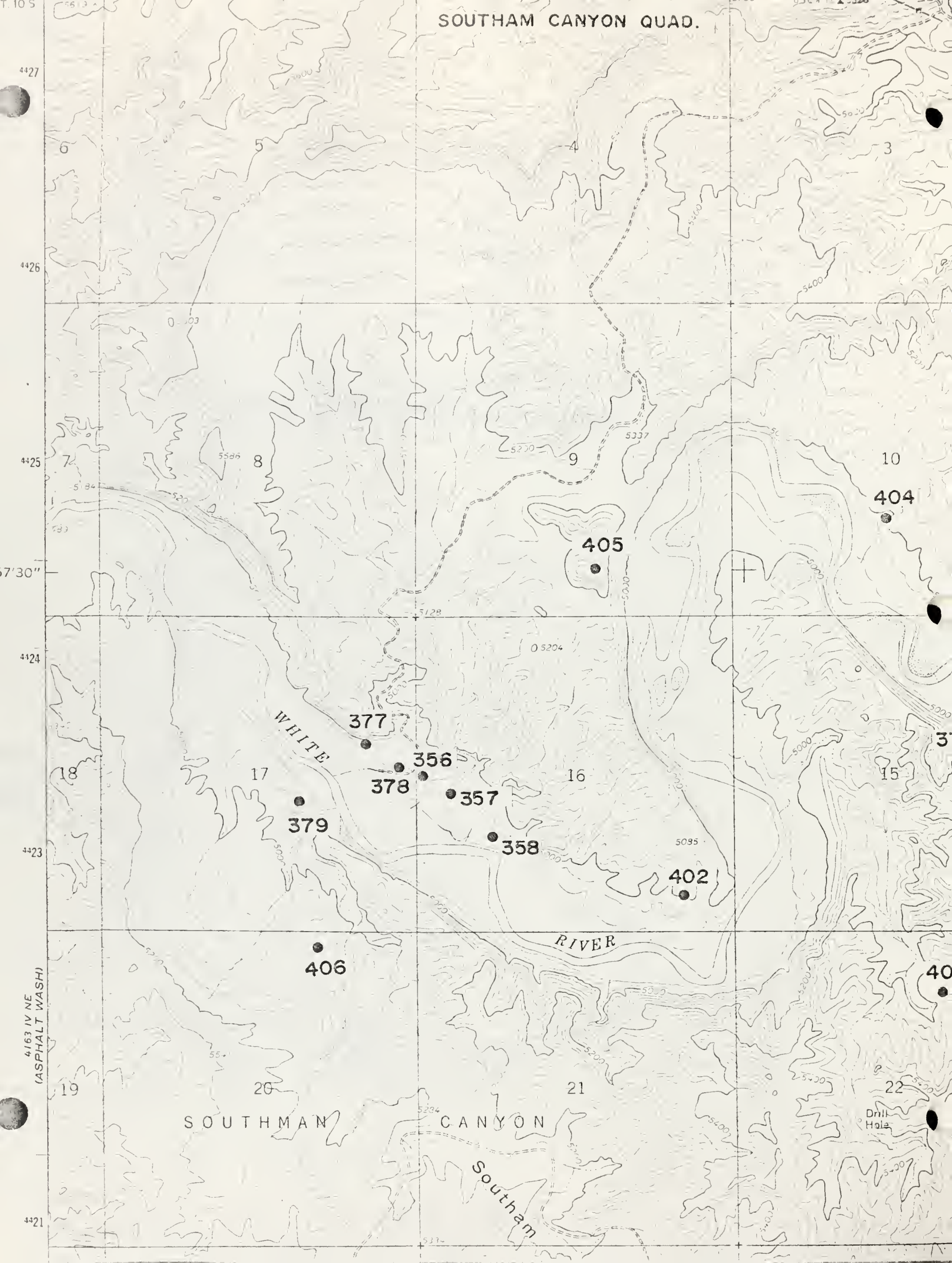
25
30
Asphalt
ASPHALT WASH QUAD.
35
36
31
Wash
R 23 E
R 24 E
TIOS
TIIS
5370
5858
5975
5400
6
1
2
5948
Well
Prospects
365
Gas Well
Hanging Rock Hollow
FIELD
Landing Strip
USLM 8
Prospect
R23E
R24E
West Fk.
Center Fork
7
8
12


SOUTHAM CANYON QUAD.
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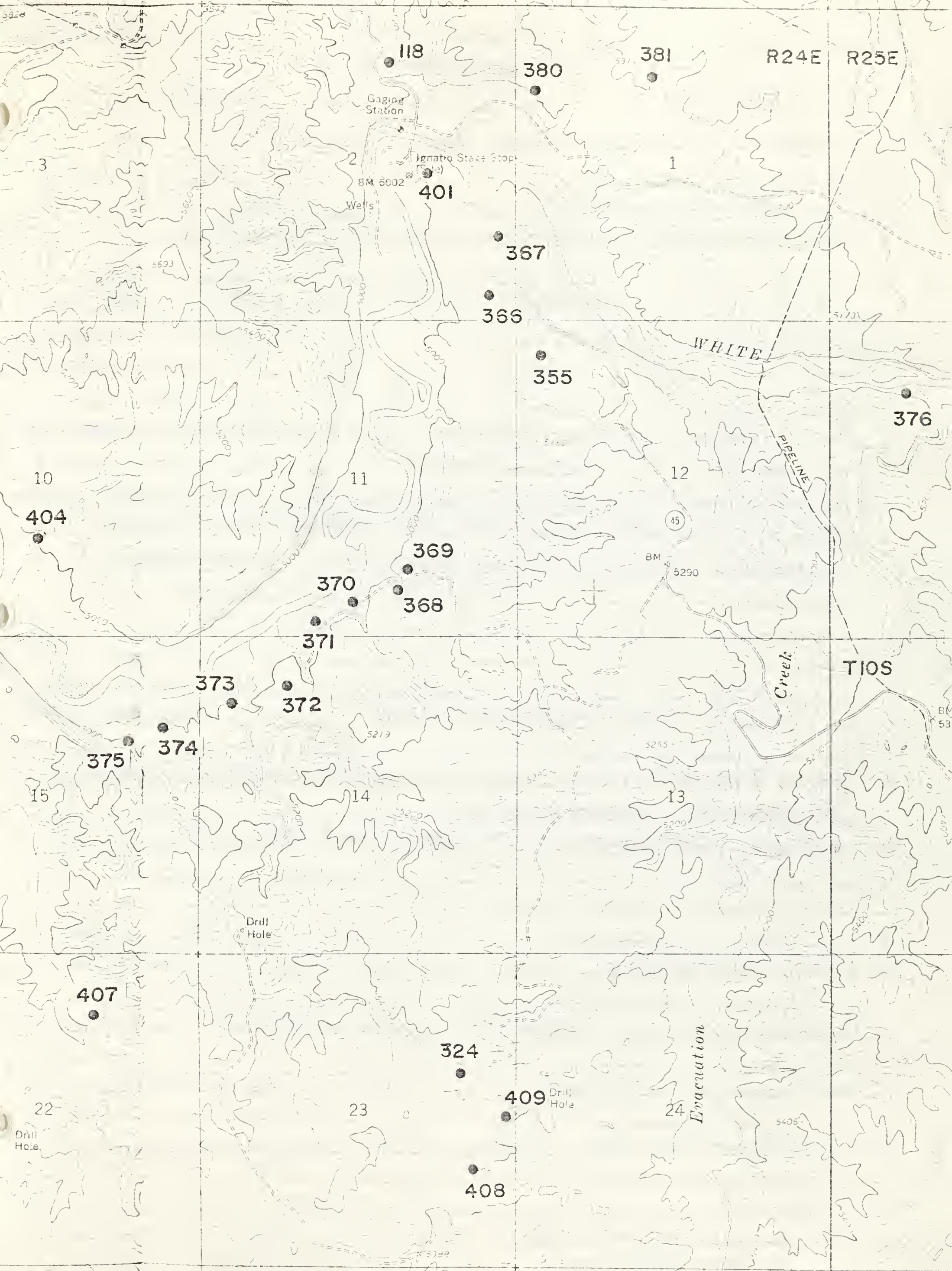
377
356
378
357
379
358
402
406
WHITE
RIVER
SOUTHMAN
CANYON
Southam
Drill Hole
4163 IV NE
(ASPHALT WASH)
5000
5200
5400
5337
5128
5204
5095


118
380
381
R24E
R25E
Gaging Station
Ignatio Stage Stop (Site)
BM 6002
Wells
401
3
2
1
367
366
WHITE
355
376
PIPELINE
10
11
12
404
45
BM
5290
369
370
368
371
Creek
T10S
373
372
374
375
15
14
13
Drill Hole
407
324
409
Drill Hole
22
23
24
Evacuation
Drill Hole
408

Antiquity Section

SITE SURVEY SHEET
Archeological Survey

Division of State History

Site No. 42Un118 County Uintah State Utah

1. Map Reference U.S.G.S. Southam Canyon Quad.
2. Type of Site Rockshelter
3. Cultural Affiliation (if known) Unknown
4. Location East side of highway 45, ca. ½ mile north of White River Bridge

NW¼, NE¼ Sec. 2 T. 10S R. 24E

5. Owner and Address State of Utah
6. Previous Owners N.A.
7. Tenant N.A.
8. Informants Previously recorded by Gunnerson in 1954 (University of Utah Survey Files)
9. Previous Designations for Site Wagon Hound Alcove
10. Site description, position, & surrounding terrain Large rock overhang protects cultural deposits over an area ca. 50 m. (n-s) by 15 m. (e-w). Shelter is ca. 10 m. high.

    Site has been extensively vandalized, exposing deep, stratified cultural deposits.
11. Area of Occupation ca. 50 m. (n-s) by 15 m. (e-w).
12. Depth and Character of Fill Alluvial deposits interspersed with lenses of charcoal and burned soil. Possibly 2.0 m. deep.
13. Present Condition Heavily potted but some deposits remain undisturbed.
14. Material Collected corn cobs
15. Material Observed corn cobs, chipping debris, charred animal bone
16. Material Reported and Owner None
17. Recommendations for Further Work Excavate
18. Photo Nos.
19. Type of map made by survey party None

Recorded by Michael S. Berry Date 7-17-74

Antiquity Section | SITE SURVEY SHEET | Division of State History

Archeological Survey

Site No. 42Un324 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS, 7.5 min.
2. Type of Site Rock Shelter
3. Cultural Affiliation (if known)
4. Location Straight east of Southam Canyon 2.5 miles and west of Evacuation Creek 1 mile. 1.25 miles SE of White River.

Sec. SE¼, NE¼, 23 T. 10S R. 24E

5. Owner and Address BLM
6. Previous Owners ---
7. Tenant none
8. Informants none
9. Previous Designations for Site BLM # AR43-08-41
10. Site description, position, & surrounding terrain Very slight overhang with southern exposure, partial projectile point, very few chips, some bone and charcoal. Trash appears very light, if any, and occupation short. However, sand fill appears deep and interlaced with charcoal.
11. Area of Occupation 130'x12'
12. Depth and Character of Fill see #10
13. Present Condition good
14. Material Collected none
15. Material Observed see #10
16. Material Reported and Owner none
17. Recommendations for Further Work none
18. Photo Nos. BLM roll 1 number 12 & 13
19. Type of map made by survey party

Recorded by Richard E. Fike Date 11-12-72

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un355 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Rock Shelter

3. Cultural Affiliation (if known) Archaic

4. Location 200 ft. south of road at .8 mile north of benchmark. First major outcropping of sandstone if driving south.

Sec. NW¼, NW¼, 12 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site ---

10. Site description, position, & surrounding terrain Sandstone outcrop. Rock shelter on west side of outcrop. Front of shelter slopes into sagebrush covered depression, slopes up to knoll 100 ft. south of shelter.

11. Area of Occupation indeterminable

12. Depth and Character of Fill sand

13. Present Condition Undisturbed. Chips found entire length of shelter (8'x60')

14. Material Collected flint chips, notched point (Elko side-notched)

AS 74.6.1 MSB 2/6/75

15. Material Observed flint , no charcoal or smoke stains

16. Material Reported and Owner ---

17. Recommendations for Further Work none

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Dixon Hindley Date 7-17-74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un356 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) unknown

4. Location ca. 6.5 airline miles SW of Bonanza, Utah where three tributary arroyos intersect the White River. Site lies between the two west of the 3 arroyos, 250 m. N of present river. Sec. NW¼, SW¼, 16 T. 10S R. 24E

5. Owner and Address State of Utah

6. Previous Owners N.A.

7. Tenant none

8. Informants N.A.

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site consists of a scattering of chipping debris on an alluvial terrace on the north bank of the White River.

11. Area of Occupation 25 meters in diameter

12. Depth and Character of Fill unknown

13. Present Condition eroded to terrace gravels

14. Material Collected flakes (worked and unworked) and chipping debris. Collection was destroyed in fire of July 27, 1974 No accession

15. Material Observed see #10 above

16. Material Reported and Owner ---

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Michael Berry Date 7-26-74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un357 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) probably Archaic
4. Location Ca. 6.5 miles SWoof Bonanza, Utah where three tributary arroyos intersect the White River. Midway between two easternmost of arroyos. ca 150 m. N of present river. Sec. NW¼,SW¼, 16 T. 10S R. 24E
5. Owner and Address State of Utah
6. Previous Owners n.a.
7. Tenant none
8. Informants N.A.
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site consists of a single Elko side-notched projectile point and a sparse concentration of chipping debris
11. Area of Occupation 5 meters in diameter (chipping debris)
12. Depth and Character of Fill Site lies directly on alluvial gravel terrace, no soil present.
13. Present Condition eroded
14. Material Collected Elko side-notched point and chipping debris. Destroyed in fire of July 27, 1974. One point recovered from burnt camp Oct. 5, 1974 Lost 6 Feb 75 M
15. Material Observed See #10 Above No accession
16. Material Reported and Owner See #14
17. Recommendations for Further Work test
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Michael S. Berry Date July 26, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un358 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) probably Fremont or Numic
4. Location Ca. 6.5 miles SW of Bonanza, Utah where three tributary arroyos intersect the White River. Ca. 50 m. to east of easternmost of three arroyos on terrace (n.bank)center of Sec. SW¼,16 T. 10S R. 24E
5. Owner and Address State of Utah
6. Previous Owners ---
7. Tenant none
8. Informants ---
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site consists of a single triangular projectile point lying on the surface of the terrace gravels. There was no other cultural material in the immediate vicinity.
11. Area of Occupation ---
12. Depth and Character of Fill terrace gravels, no soil present
13. Present Condition see #12
14. Material Collected Small triangular projectile point. Destroyed in fire of July 27, 1974. Straight, serrated edges, basal thinning but notches not present

No accession

15. Material Observed ---
16. Material Reported and Owner see #14
17. Recommendations for Further Work none
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Michael S. Berry Date 7/26/74

Antiquity Section *Division of State History*

SITE SURVEY SHEET
Archeological Survey

Site No. 42Un365 County Uintah State Utah

1. Map Reference Asphalt Wash Quad, USGS

2. Type of Site Rock Shelter

3. Cultural Affiliation (if known) probably Fremont

4. Location Mouth of Hanging Rock Hollow; ca. 300 m. north of the confluence of the center fork and west fork of Ashphalt Wash.

Sec. SE¼,SW¼, 6 T. 11S R. 24E

5. Owner and Address unknown

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Large (ca. 100 ft. wide; 25 ft. high and 20 ft. deep) rock shelter containing possible coarsed masonry granary on north side of Hanging Rock Hollow. Burned bone and charcoal present on surface. Granary measures ca. 20 x 8 ft. and has only one or two courses of masonry intact.

11. Area of Occupation ca 100 x 25 ft.

12. Depth and Character of Fill unknown

13. Present Condition The granary walls have been toppled; no apparent looters' pits. Shelter has been utilized in historic times and is littered with machinery parts and rusty tin cans.

14. Material Collected One Desert side-notched projectile point.
AS.74.7.1

15. Material Observed Charcoal, burned anaimal bones; no pottery observed, no chipping.

16. Material Reported and Owner ---

17. Recommendations for Further Work excavate

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Michael S. Berry Date 8/10/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un366 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Rock Shelter with Pictographs
3. Cultural Affiliation (if known) possibly Archaic and Fremont
4. Location Site ca. ½ mile south at the White River Bridge on the Bonanza to Dragon Road. Located west of road in the first arroyo south of the bridge.

Sec. SE¼,SE¼, 2 T. 10S R. 24E

5. Owner and Address State of Utah
6. Previous Owners ---
7. Tenant none
8. Informants Bud Thompson, Bonanza
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site is a shallow alcove ca. 250 ft. long (EW). Dripline varies from 5 to 15 ft. from rear of alcove. Three pictographs are red ochre anthropomorphs. One of these is a "horned" "Fremont" figure and is adjacent to a "snakelike" red ochre pictograph. Petroglyphs of a horse and mountain sheep are also present, but these may be of "recent" orientation.
11. Area of Occupation Ca. 250 by 10 feet
12. Depth and Character of Fill Looters pits contain charcoal to a depth of at least 18 inches
13. Present Condition The deposits have been dbadly potted but there is still quite a bit of "virgin" dirt left.
14. Material Collected Flakes and chipping debris
15. Material Observed charcoal, burnt bone, chipping debris. No pottery.

AS 74·8·1

16. Material Reported and Owner Bud Thompson recovered two projectile points -- will try to identify.
17. Recommendations for Further Work excavate
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Michael Berry Date August 10, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un367 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Rock Shelter
3. Cultural Affiliation (if known) possibly Archaic
4. Location Site is ca. ½ mile south of White River. 50 yds south of the Bonanza to Dragon Road. 3/4 mile east and south of White/ iver Bridge.

Sec. SE¼,SE¼, 2 T. 10S R. 24E

5. Owner and Address State of Utah
6. Previous Owners ---
7. Tenant none
8. Informants Bud Thompson, Bonanza, Utah
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site is a shallow alcove 100 ft. long (NS). Dripline varies from 5-10 ft. from rear of alcove.
11. Area of Occupation alcove
12. Depth and Character of Fill 2 ft. with charcoal deposits and chipping debris
13. Present Condition Looters' pits have virtually destroyed all fill. One 3 ft. strip of deposit remains undisturbed.
14. Material Collected ---
15. Material Observed flakes and chipping debris. Point tip, piece of biface.
AS 74.9:1
16. Material Reported and Owner charcoal, chipping debris, No pottery.
17. Recommendations for Further Work test
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Christian K. Lund Date August 10, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un368 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open; (riverline)

3. Cultural Affiliation (if known) possibly Archaic

4. Location Site located 100 yds east of the White River. Directly south of river access road. Ca. 1½ miles from Bonanza to Dragon road.

Sec. SW¼,SE¼, 11 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site is 200 ft. long and 100 ft. wide bounded by a sheer cliff on the west, a deep arroyo on the north, a shallow wash on the south and a jeep trail on the east. Site is on a pleistocene river terrace with most fill eroded. It is sparsely covered with sage brush.

11. Area of Occupation 200 ft. (EW) by 100 ft. (n-s)

12. Depth and Character of Fill varies from a few inches to 1½ ft.

13. Present Condition undisturbed

14. Material Collected One blade point, chipping debris. No pottery

AS 74.10.1

15. Material Observed rusted cans, rifle shells, chipping debris

16. Material Reported and Owner ---

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Christian K. Lund Date August 11, 1974

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un369 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location Ca. 1.5 miles due south of the Ignacio Stage stop on the east bank of the White River.

Sec. NW¼,SE¼, 11 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site consists of an extensive concentration of lithic debris, finished artifacts and fire-cracked river cobbles on a pleistocene terrace on the east bank of the White River. One fire hearth is eroding out and ash is present on the surface in association with fire-cracked cobbles.

11. Area of Occupation Ca. 300 ft. (N-S) by 200 ft. (E-W)

12. Depth and Character of Fill May have considerable depth since terrace has not eroded down to cobbles over most of the area.

13. Present Condition Site has been picked over but no looter's pits present.

14. Material Collected Biface fragments, worked and unworked chips, chipping debris. AS 74.11.1

15. Material Observed see #14

16. Material Reported and Owner ---

17. Recommendations for Further Work excavate

18. Photo Nos. none

19. Type of map made by survey party none

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un370 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location Site located ca. 1½ mile directly south of White River bridge on the east bank of White River.

Sec. SE¼,SW¼, 11 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site is on pleistocene terrace 40 ft. above present banks of the White River. The site is 300 ft. (E-W) 100 ft. (N-S); a relatively level mound. Sage and greasewood scattered over surface.

11. Area of Occupation 300 ft. x 100 ft.

12. Depth and Character of Fill eroded to gravels. Considerable deposits of possible depth.

13. Present Condition undisturbed

14. Material Collected ---

15. Material Observed chipping debris, one biface fragment, one arrowhead, numerous fire-blackened river cobbles, No pottery. Acc. AS 74·14·1

16. Material Reported and Owner ---

17. Recommendations for Further Work excavate

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Christian K. Lund Date August 20, 1974

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un371 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Fremont

4. Location Site located 1½ miles south of White River bridge on east bank of the White River.

Sec. SE¼,SW¼, 11 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site is a pleisocene terrace 100 ft. east of White River. Bourdered on the north by a narrow wash, on the west by a 50 ft. cliff and on the south and east by a continuation of terrace. The site is sparsely covered by sage brush and greasewood.

11. Area of Occupation 100 ft. (E-W), 50 ft. (N-S)

12. Depth and Character of Fill 1 ft. to unknown depth

13. Present Condition undisturbed

14. Material Collected One etched slate 6"x6" pictograph of four legged creature and anthropomorph; and designs. AS 14.15.1

15. Material Observed fire blackened river cobbles. No pottery. No lithics

16. Material Reported and Owner ---

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Christian K. Lund Date August 21, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un372 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) possibly Archaic
4. Location On knoll on south bank of White River.

NW¼,NW¼, Sec. 14 T. 10S R. 24E

5. Owner and Address BLM
6. Previous Owners ---
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site lies on knoll overlooking White River; arroyos on either side. Covered with low sage, slat brush and sarcobatus. Five cottonwood trees found immediately below knoll along river.
11. Area of Occupation scattered chipping over entire surface of knoll, Ca. 100 meter diameter
12. Depth and Character of Fill apparently none
13. Present Condition undisturbed
14. Material Collected chipping debris
AS 74.16.1
15. Material Observed See #11 above
16. Material Reported and Owner see #11
17. Recommendations for Further Work none
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by David B. Madsen Date 8/21/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un373 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location On knoll overlooking south bank of White River.

NW¼, NW¼ Sec. 14 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners ---

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain See 42Un372. Site 42Un373 is ca. 200 meters west of 372 and terrain is identical.

11. Area of Occupation 100 by 100 ft.

12. Depth and Character of Fill possibility of considerable depth

13. Present Condition no evidence of looters pit. Surface has probably been picked over.

14. Material Collected chipped stone

AS.74.17.1

15. Material Observed chipped stone and fire-cracked river cobbles

16. Material Reported and Owner N.A.

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Michael S. Berry Date

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un374 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) possibly Archaic
4. Location On a knoll overlooking the south bank of White River.

SE¼, NE¼ Sec. 15 T. 10S R. 24E

5. Owner and Address BLM
6. Previous Owners N.A.
7. Tenant none
8. Informants N.A.
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Dense concentration of fire-cracked river cobbles and chipping debris.
11. Area of Occupation Ca. 100 x 100 ft.
12. Depth and Character of Fill May be as deep as 4 feet, knoll may be accretionary
13. Present Condition surface picked over, no evidence of looters pits.
14. Material Collected chipped stone AS 74.13.1
15. Material Observed chipped stone and fire cracked and blackened cobbles
16. Material Reported and Owner N.A.
17. Recommendations for Further Work test
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Michael Berry Date 8/21/74

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un375 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location On a knoll overlooking a cottonwood covered flat on the south bank of the White River. Knoll lies between two dry arroyos.

approx. center, NE¼ Sec. 15 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners N.A.

7. Tenant none

8. Informants N.A.

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site consists of a heavy concentration of fire-cracked river cobbles and chipping detritus

11. Area of Occupation Ca. 100 x 150 ft.

12. Depth and Character of Fill possibly quite deep. Artifacts eroding out of knoll.

13. Present Condition no obvious looter pits

14. Material Collected chipped stone and one large sandstone projectile point tip (non-diagnostic) AS 74·19·1

15. Material Observed river cobbles - fire cracked

16. Material Reported and Owner N.A.

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party none

Recorded by Michael Berry Date 8/21/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un376 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) possibly Archaic - Fremont
4. Location On the south bank of the White River ca. 200 m. west of the confluence of White River and Evacuation Creek.

NW¼, NW¼ Sec. 7 T. 10S R. 25E

5. Owner and Address BLM
6. Previous Owners ---
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Chipping debris and projectile points on a gradually sloping talus slope overlooking the White River. Minor concentrations of fire-cracked cobbles.
11. Area of Occupation Ca. 20' x 20'
12. Depth and Character of Fill talus, probably no depth
13. Present Condition
14. Material Collected One Elko eared projectile point. One desert side-notched projectile points Chipping debris. No pottery AS 74-20.1
15. Material Observed same as #10 and #14, also fire cracked cobbles
16. Material Reported and Owner N A.
17. Recommendations for Further Work
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by Michael Berry Date 8/23/74

Antiquity Section

SITE SURVEY SHEET

Division of State History

Archeological Survey

Site No. 42Un377 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location Site located ca. 5 miles by jeep trail from White River on the north bank of the White River. Directly north of a log structure in "Wets" canyon.

SE¼, NE¼ Sec. 17 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners N.A.

7. Tenant none

8. Informants Bud Thompson of Bonanza

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site located on pleistocene terrace 500 yds north of present course of White River. Terrace rises gradually from flood plain on the south. North of site terrace rises sharply for 50' and then verticle sandstone wall stands 200' above terrace. Site is 75' (EW) 50' (N-S). Two large sandstone rocks bound the site on the north and south. Surface is covered with talus.

11. Area of Occupation 75' (E-W) x 50' (N-S)

12. Depth and Character of Fill considerable depth with charcoal, debris and fire-blackened rock.

13. Present Condition Looted by informant Bud Thompson who claims to have extracted 85 arrowheads. Site is excavatable in one or two places.

14. Material Collected chipping debris, point tip. No pottery.

AS 74.21.1

15. Material Observed charcoal deposits, fire-blackened cobbles, debris

16. Material Reported and Owner N.A.

17. Recommendations for Further Work Excavate

18. Photo Nos. none

19. Type of map made by survey party excavate

Recorded by Christian K. Lund Date 8/24/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un378 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Archaic

4. Location On the north bank of the White River on a terrace remnant adjacent to the south side of wash road from Wagon Hound Canyon.

SE¼, NE¼ Sec. 17 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners none

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Scattering of lithic debris and artifacts on terrace remnant. Vegetation predominated by greasewood.

11. Area of Occupation Ca. 200 x 200 feet.

12. Depth and Character of Fill gravels, probably not much depth.

13. Present Condition Probably been picked over a great deal, but no pot holes

14. Material Collected One small, stemmed projectile point, one crude biface, chipping debris. AS 74.22.1

15. Material Observed See #10 and 14. Also fire-redened river cobbles

16. Material Reported and Owner N.A.

17. Recommendations for Further Work test

18. Photo Nos. none

19. Type of map made by survey party N.A.

Recorded by Michael Berry Date 8/24/74

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un379 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) unknown

4. Location On a knoll overlooking the south bank of the White River at a confluence of a major arroyo, leading in Southman Canyon and the White River. NW¼, SE¼, Sec. 17 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners none

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Terrace remnant overlooking the White River. Sparse scattering of chipping debris and core fragments. One vaguely rectangular stone outline may be a tipi ring.

11. Area of Occupation Ca. 200 x 200 ft.

12. Depth and Character of Fill Soil eroded down to terrace gravels--no depth

13. Present Condition Probably picked over quite extensively. Lots of litter from a cowboy or hunting camp.

14. Material Collected core fragments, chipping debris

AS 74.23.1

15. Material Observed See # 10 and #14

16. Material Reported and Owner N.A.

17. Recommendations for Further Work

18. Photo Nos. none

19. Type of map made by survey party N.A.

Recorded by Michael Berry Date 8/25/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un380 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known) possibly Archaic
4. Location North bank of the White River, ca 1/4 mile east of the White River Bridge

NW¼, NW¼, Sec. 1 T. 10S R. 24E

5. Owner and Address BLM
6. Previous Owners none
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain One projectile point fragment on a pleistocene gravel terrace on the north bank of the White River.
11. Area of Occupation N.A.
12. Depth and Character of Fill Probably none -- soil eroded down to gravels.
13. Present Condition
14. Material Collected One large triangular, side-notched point fragment

AS 74.24.1

15. Material Observed See #10 and #14 above
16. Material Reported and Owner N.A.
17. Recommendations for Further Work
18. Photo Nos. none
19. Type of map made by survey party N.A.

Recorded by Michael Berry Date 8/26/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un331 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Rock Shelter
3. Cultural Affiliation (if known) unknown
4. Location Ca. 1/3 mile (NE) from the White River. Ca. one mile from the White River Bridge along jeep trail through White River city up second wash.
NE¼, NW¼ Sec. 1 T. 10S R. 24E
5. Owner and Address BLM
6. Previous Owners N.A.
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Site is positioned in the SW part of a semicircular sandstone outcrop. Area below shelter falls away sharply and is littered with rock spall. Shelter is 30' (N-S) 8' (E-W) from dripline to deepest part of ceiling--smoke stained.
11. Area of Occupation 30' (N-S) 8' (E-W)
12. Depth and Character of Fill at least one foot
13. Present Condition Looted; a meter square pit is dug beneath smoke stain.
14. Material Collected none
15. Material Observed fire-blackened river cobbles, charcoal in looters' back dirt
16. Material Reported and Owner N.A.
17. Recommendations for Further Work
18. Photo Nos. none
19. Type of map made by survey party N.A.

Recorded by Christian K. Lund Date 8/26/74

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un401 County Uintah State Utah

1. Map Reference Southan Canyon Quad, USGS
2. Type of Site Open; campsite and historic structure
3. Cultural Affiliation (if known) historic Anglo; probable Fremont
4. Location On bluff on south side of White River. Ca. 50 meters east of Utah Highway 45.

NE¼, SE¼ Sec. 2 T. 10S R. 24E

5. Owner and Address State of Utah
6. Previous Owners --
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Remaining buildings of the Ignatio stage stop overlay the western portion of the archeological site. To the south the terrain rises gradually and is cut by numerous arroyos. High cliffs are found on the north side of the river. Vegetation is sparse, consisting of scattered grass, sagebrush, eriogonum and cactus. Site consists of scattered lithic debris, pottery and ground stone on surface. There is a possible 4x7 meter structure of slabs & irrigular rock.
11. Area of Occupation 100 x 100 meters
12. Depth and Character of Fill trash heaps associated with the stage stop are ca. 1 meter deep. Depth of archeological site is unknown.
13. Present Condition some potting, but basically undisturbed
14. Material Collected lithic debris, corrugated gray pottery and ground stone

AS 74.50.1

15. Material Observed same as #14 above, plus historic artifacts
16. Material Reported and Owner --
17. Recommendations for Further Work testing of archeological site
18. Photo Nos. SDD 30 through 36
19. Type of map made by survey party --

Recorded by Stanley D. Davis Date December 1, 1974

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un402 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Rock Shelter

3. Cultural Affiliation (if known) --

4. Location On north side of White River on a high bluff, sitting between two higher portions (in saddle) of the bluff.

SE¼, SE¼ Sec. 16 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners --

7. Tenant none

8. Informants none

9. Previous Designations for Site unknown

10. Site description, position, & surrounding terrain A bluff with shelter on north side of river between 2 high portions of the bluff (in saddle). Faces So. toward river. Terrain drops gently to upper (older) terrace of river. Shelter runs east, west along face of bluff. Shelter is 10 to 15 meters deep. Vegetation is greasewood, rabit brush, cactus.

11. Area of Occupation 75 meters (E-W) and 75 meters (N-S) toward river

12. Depth and Character of Fill wind blown material & animal dung. Some erosion on front portion of site.

13. Present Condition Good, some digging has taken place (about 6" deep and 4' long on eastern portion of site).

14. Material Collected flakes, scrapers, bifaces, choppers (large & small), hammer stone mano frag. AS 74.51.1

15. Material Observed same as #14 above and chipping debris

16. Material Reported and Owner none

17. Recommendations for Further Work test

18. Photo Nos. White River SDD 1,2,3,4

19. Type of map made by survey party --

Recorded by Stanley D. Davis Date December 14, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un403 County Uintah State Utah

1. Map Reference Rainbow Quad, USGS

2. Type of Site Pictograph

3. Cultural Affiliation (if known) --

4. Location Ten ft. off north side of road cut on sandstone cliff facing south. Ten ft. below crest of small cliff.

SE¼, SE¼ Sec. 23 T. 11S R. 24E

5. Owner and Address BLM

6. Previous Owners --

7. Tenant none

8. Informants none

9. Previous Designations for Site unknown

10. Site description, position, & surrounding terrain Possible bighorn sheep--8½" long by 6" high pictograph on sandstone cliff 10 ft. below top and 10 ft. north of road cut. Vegetation: juniper, greasewood, grasses, sage, pinyon pine. Terrain is disected by many canyons and is generally undulating in nature. No cultural material found.

11. Area of Occupation pictograph on side of cliff

12. Depth and Character of Fill not applicable

13. Present Condition Good, recent illegible signatures scratched into cliff face (historic), approx 2 ft. east of pictograph

14. Material Collected none, not applicable

15. Material Observed pictograph

16. Material Reported and Owner not applicable

17. Recommendations for Further Work none

18. Photo Nos. #5, SDD, White River

19. Type of map made by survey party --

Recorded by John T. Autrey Date December 20, 1974

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un404 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Rock Shelter
3. Cultural Affiliation (if known) --
4. Location South of dirt road just north of White River. Shelter faces west on north bank of River.

NE¼, SW¼ Sec. 10 T. 10S R. 24E

5. Owner and Address --
6. Previous Owners --
7. Tenant --
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain Sandstone bluff 15 yards above north edge of White River. Rock Shelter faces west. Drainage wash runs directly below bluff. The front or west portion of the deposit has been washed away. Accumulation of material is greater than 4 ft. Possible projectil e point was found on surface on the inner protion of the rock shelter on the south end.
11. Area of Occupation 30 meters long by 15 meters deep
12. Depth and Character of Fill Greater than 4 ft., composed of wind blown sand, gravel, sheep dung
13. Present Condition front portion of fill eroded into drainage wash
14. Material Collected possible projectile point or knife (large)
AS 74.53.1
15. Material Observed same as #14 above
16. Material Reported and Owner none
17. Recommendations for Further Work test
18. Photo Nos. SDD, White River #6,7,8
19. Type of map made by survey party --

Recorded by John T. Autrey Date December 20, 1974

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un405 County Uintah State Utah

1. Map Reference Southam Quad, USGS

2. Type of Site Open

3. Cultural Affiliation (if known) possibly Plains

4. Location In Wetts Canyon ca. 1.5 miles north of the White River terminus of the Wetts Canyon Road.

W½, SE¼ Sec. 9 T. 10½S R. 24E

5. Owner and Address BLM

6. Previous Owners n.a.

7. Tenant none

8. Informants Bud Thompson of Bonanza

9. Previous Designations for Site Breaking wind Butte

10. Site description, position, & surrounding terrain A prominant butte ca. 300 meters east of the Wetts Canyon Road. Surface is ca. 250 ft. above surrounding terrain. Chipping debris thinly scattered over surface of butte. Large sandstone slabs have been stacked around the periphery of the butte to form a crude wall. Three possible "teepee" rings.

11. Area of Occupation ca. 100 m by 200 m.

12. Depth and Character of Fill site lies primarily on bedrock--some aelion deposits

13. Present Condition Due to its inaccessability, the site has probably not been picked over too badly.

14. Material Collected chipping debris, one possible stone pipe fragment

AS 74.[illegible].49.1

15. Material Observed sandstone slab "wall" -- three sub-rectangular rock alignments

16. Material Reported and Owner not applicable

17. Recommendations for Further Work detailed mapping and photographs

18. Photo Nos.

19. Type of map made by survey party none

Recorded by Michael S. Berry Date October 21, 1974

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un406 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS 7.5'

2. Type of Site Open

3. Cultural Affiliation (if known)

4. Location On two adjacent, low, flat knolls in Southam Canyon, ca. ¼ mi. SW of White River and ca. 6 mi. SW of Bonanza

NW¼, NE¼ Sec. 20 T. 10S R. 24E

5. Owner and Address

6. Previous Owners

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Artifacts: (2) crude bifaces and (1) possible hammerstone (no debitage), located on low, flat knoll. Ca. 30 meters to SW some stone rubble amidst historic debris--ca. 30 m. apart. Vegetation: *Atriptex*, crysothymus and sage -- sparse

11. Area of Occupation 100 m.

12. Depth and Character of Fill rocky -- no soil depth

13. Present Condition eroded

14. Material Collected (2) crude bifaces, (1) possible hammerstone

15. Material Observed Stone rubble in crude circular alignment; may be historic only.

16. Material Reported and Owner none

17. Recommendations for Further Work none

18. Photo Nos. none

19. Type of map made by survey party see attached map

Recorded by LaMar W. Lindsay Date 5-18-75

SITE SURVEY SHEET

Archeological Survey

Site No. 42Un407 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Rockshelter

3. Cultural Affiliation (if known)

4. Location From White River bridge go South for ca. 2 miles to fork in road. Take right fork for ca. 3 mi. and turn right on dirt road. Total distance from White River (cont.) NW¼, NE¼ Sec. 22 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners --

7. Tenant --

8. Informants --

9. Previous Designations for Site --

10. Site description, position, & surrounding terrain Large shelter 15' high and 10' deep on north side of unnamed tributary wash of the White River. No surface indications of occupation but two potholes have exposed alluvial deposits containing charcoal and chipping debris.

11. Area of Occupation 150 ft. by 10 ft.

12. Depth and Character of Fill sandy alluvium, ca. 18" deep

13. Present Condition potholes have done minimal damage

14. Material Collected chipping debris, one biface fragment recovered from potholer's back dirt

15. Material Observed same as above

16. Material Reported and Owner none

17. Recommendations for Further Work test

18. Photo Nos.

19. Type of map made by survey party none

Recorded by Michael S. Berry Date May 18, 1975

SITE 42Un407 DATE 5-18-75

Location, cont. from page 1

bridge to turn-off is 5.0 mi. Follow dirt road for 1.5 mi. Site is a shallow alcove on right hand side of road.

Antiquity Section

SITE SURVEY SHEET

Archeological Survey

Division of State History

Site No. 42Un408 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS
2. Type of Site Open
3. Cultural Affiliation (if known)
4. Location Along road to Southam Canyon, ca. 3½ mi. SW of U-45; ca. 2 mi. SE of the White River and ca. 1 mi. west of Evacuation Creek.

   NE¼, SE¼ Sec. 23 T. 10S R. 24E
5. Owner and Address BLM
6. Previous Owners --
7. Tenant none
8. Informants none
9. Previous Designations for Site none
10. Site description, position, & surrounding terrain (1) flint flake and evidence of potting located below 6 m. high overhang. Vegetation: Juniper, sage and *Atriplex*.
11. Area of Occupation unknown; probably ca. 10 to 15 m. E-W
12. Depth and Character of Fill sand and some spall; site may have some depth
13. Present Condition some potting, site may have some depth
14. Material Collected none
15. Material Observed (1) flake plus several red stone nodules that do not appear to be indigenous to area
16. Material Reported and Owner none
17. Recommendations for Further Work test excavation
18. Photo Nos. none
19. Type of map made by survey party none

Recorded by LaMar W. Lindsay Date May 19, 1975

Antiquity Section SITE SURVEY SHEET *Division of State History*

Archeological Survey

Site No. 42Un409 County Uintah State Utah

1. Map Reference Southam Canyon Quad, USGS

2. Type of Site Rockshelter

3. Cultural Affiliation (if known)

4. Location Ca. 5 m. west of jeep trail trending N-S through east edge of Sec. 23, ca. 3 mi. from White River bridge on section line dividing Secs. 23 & 24. NE¼, SE¼ Sec. 23 T. 10S R. 24E

5. Owner and Address BLM

6. Previous Owners not applicable

7. Tenant none

8. Informants none

9. Previous Designations for Site none

10. Site description, position, & surrounding terrain Site is sandstone outcrop 6-7 meters high, 15 m. E-W, 5 m. N-S. Alcove is shallow (ca. 1 m.); area of habitation is ca. 5 m. (E-W) by 5 m. (N-S) site is highly eroded. Promontory extends eastward from alcove toward Evacuation Wash. Wash is ca. ½ mi. from site. Vegetation: juniper with pinyon (infrequently)

11. Area of Occupation 5 m. (E-W) by 5 m. (N-S)

12. Depth and Character of Fill possible depth; two fire stains visible

13. Present Condition probably picked over by treasure hunters. Adjacent to heavily traveled road. Numerous indications of recent encampments.

14. Material Collected river cobble with hammer scars; biface base (found on promontory), obsidian chips (questionable provenience; found in jeep trail

15. Material Observed -- 50 m. from alcove).

16. Material Reported and Owner none

17. Recommendations for Further Work

18. Photo Nos.

19. Type of map made by survey party

Recorded by Christian K. Lund Date May 22, 1975

A SHORT HISTORY OF THE
UINTA BASIN, UTAH

Floyd A. O'Neil
Gregory C. Thompson

American West Center
University of Utah

1975

7600146

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INTRODUCTION

The purpose of this investigation is to offer a historical survey of the Uinta Basin with special emphasis on an on-the-ground analysis of select tracts of land and historic sites in the White River area. This study was conducted under contract with VTN, Colorado, Inc. and is intended to provide background data for decisions made in conjunction with federal estate requirements. Principal investigators are Dr. Floyd A. O'Neil, Associate Director, American West Center, University of Utah, and Mr. Gregory C. Thompson, researcher, American West Center, University of Utah. The report is divided into two sections: (1) a general chronologically ordered discussion of the history of the Uinta Basin, and (2) description and specific history of historic sites in the oil shale survey area.

SYNPOSIS

The recorded history of the Uinta Basin began in 1776 with the penetration of that area by the Dominguez-Escalante expedition. Not until the 1820s, however, did historical activity of any endurance commence. Beginning at that time and extending into the 1840s, mountain men drifted in and out of the basin in search of furs; they established transitory trading posts and engaged in commercial transactions with Indians who frequented the area. Following the great migrations of the 1840s and 1850s into the American West, whites came into conflict with Ute bands in central Utah and western Colorado, finally forcing them onto a reservation established in the Uinta Basin by President Lincoln in 1861. Throughout the remainder of the nineteenth century, the history of the basin was generally dominated by Indians, federal officials, and a small group of white opportunists.

Permanent white settlement of the Uinta Basin began in the 1870s, under the stimulus of agricultural and mineral speculation, but the scale of settlement remained modest until the early years of the twentieth century. When, in response to increasing political pressure, President Roosevelt and Congress opened the Ute reservation to white settlement in 1905, the history of the basin took a new departure. Whites began moving into the area in increasing numbers, establishing farms, churches, towns, schools, and all other social, economic and political institutions of contemporary Anglo-American civilization. They quickly outnumbered the Indians and assumed the dominant political role. Upon the economic bases of agriculture, government employment, and mining, they have enjoyed a moderate prosperity and steady growth rate to the present time.

From the vantage point of 1975, possibly due to increased needs for energy, it seems obvious that the Uinta Basin is on the verge of great social and economic change. Discussion of this will not be offered, however, since this new phase is not nearly well enough developed to invite historical analysis or comment.

GENERAL HISTORY OF UINTA BASIN

PHYSICAL SETTING

The Uinta Basin is an elongated depression with an east-west axis. Uplifts on the south and north lead to upland and some high mountain areas. Geologically, the Uinta Basin is one of the most interesting in the nation, containing such features as Split Mountain, Gilsonite dike veins, and Dinosaur National Monument with its rich trove of ancient fossils.

The area has an unusual pattern of watersheds. The Green River flows into the basin from the north through the Uinta Mountains in an exceptionally

rough area marked by steep gorges. This is the only major supply of water into the basin from another geographic area. The Green River is also the only drainage for the Uinta Basin.

Two important tributaries of the Green River, the Yampa and the White rivers, flow from the east. The White River rises in the Colorado Rockies and empties into the Green in Uintah County. The largest tributary from the west is the Duchesne River which joins the Green near Ouray in the west-central portion of the county. Other important water courses are the Uinta and Whiterocks rivers, Rock Creek, Yellowstone River, Lake Fork River, and Strawberry River.

Several deposits of minerals and petroleum are to be found in the Uinta Basin. Gold, silver, and other minerals associated in quartz are located in northeastern Uintah County, coal beds exist in Uintah and Duchesne counties, and gilsonite veins reach irregularly across the basin in an east-west axis. Oil and natural gas have been discovered in the west-central part of the Uintah County near the Green River. Asphalt has been mined from tar sands near Vernal, and some deposits are found elsewhere in the area. Sand and gravel are in great abundance, and stone can be quarried, although little has actually been utilized. Potash deposits have been extensively developed in the northern portion of Uintah County, and various minerals of lesser importance are to be found there as well.

CAPSULE ETHNOHISTORY OF THE UTE INDIANS

Historically, the Uinta Basin has been the homeland of the Ute Indians. The Utes have never been great in number, perhaps 12,000 at the most, and generally fewer than that. They occupied a vast area which covered most of the present-day states of Utah and Colorado, along with a substantial portion

of northern New Mexico. While much of the land they occupied was bleak and barren, some of it was rich and had very heavy yields of game. The Utes were hunters and gatherers.

As hunters, the Utes used areas far beyond their borders, especially in the plains around the eastern arc of their residency area. The game which formed their principal subsistence included large game such as elk, deer, bear, antelope and buffalo. A wide variety of smaller animals were also a part of their diet, as well as trout, berries, and a variety of seeds. They were skilled at using plants as medicines, as were most American Indians.

The language of the Ute is of the Shoshonean branch of the Uto-Aztecan family; it has a linguistic relationship to other tribes along the western arc of their residency area. R.H. Lowie notes that the origins of the Utes are probably to be found west of their known areas, perhaps in southeastern California. Both Lowie and A.L. Kroeber considered the Utes to be Great Basin folk.[1] The cultural and linguistic patterns tend to confirm their view. There are other evidences of the Great Basin influence, even on the groups who were resident in present-day Colorado. Rituals, hunting and gathering practices, and size of communities are somewhat similar.

Ute society was relatively simple. Extended family organization tended to serve the society best, as hunting and gathering customs dictated. There were some exceptions to the scattered pattern, such as the large group at Utah Lake where the supply of fish and game from neighboring canyons of the area allowed a concentration of several hundred people.

The Utes were not particularly aggressive in their habits and relationships. Their peaceful and passive view of the world was and is one which requires mainly a response to a need or an act rather than a preconception

about the need to change things. This rather pleasant philosophy is reflected in their economy and social and religious activities. Their social and religious concepts seem to be one, or at least joined. Their traditional ritual was the Bear Dance, held in very late winter or early spring. The ceremony was neither very formal nor very complex.

The relationships between the various Ute bands were friendly and informal. Intermarriage was regular, and the bands often joined together for brief periods of socializing. There is little evidence of struggle between the bands until after white control. One explanation for the relative ease of relationships between the bands is that the area of residency was so vast that there was little cause for conflict over resources. Further, they were relatives; intermarriage was so common that in a real way they were "a people." Probably most important of all these factors, however, was their "world view," or mind set. They simply did not tend to think about strife unless it had a specific purpose. They were a people with little of what could be called a "war ethic."[2]

The arrival of the Spaniards in New Mexico had a great effect on the Utes. They brought metal objects which were of a particular importance, but all other contributions were overshadowed by the acquisition of the horse. The Spanish horse changed Ute life profoundly; so profoundly, in fact, that one scholar is of the opinion that it is nearly impossible to describe their condition before they had the horse.[3] More recent scholarship has observed that Spanish sources demonstrate that the Utes were already big game hunters and traders of hides and dried meats by the time of the Spanish intrusion.[4] Nevertheless, Steward's point is well taken that the influence of the horse was indeed great. It increased the range

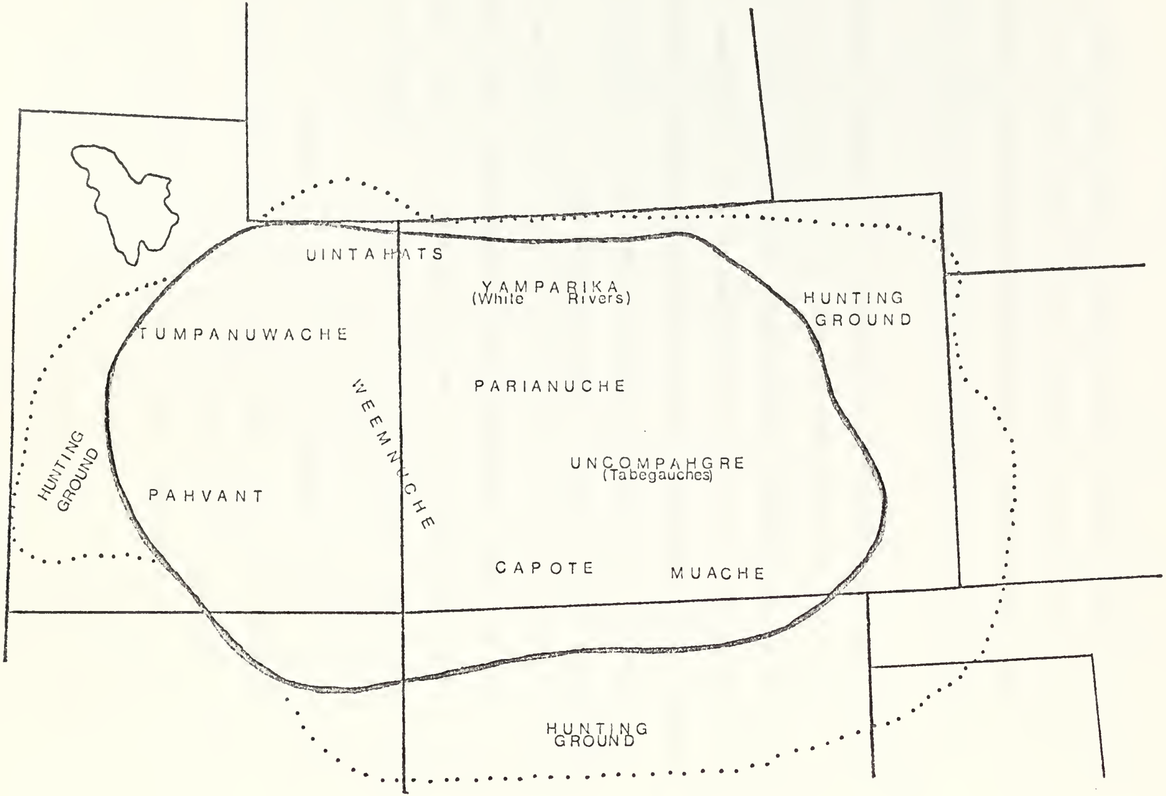
and efficiency of hunting far beyond the prior capabilities of the Utes. It allowed them to develop a unique and efficient method of defense. They made sorties on horseback from their mountains onto the plains where they were able to gather food and then quickly return to the mountains which they knew so well, and where pursuers from other tribes were at a great advantage. These methods were developed by the Colorado Utes early. The widespread use of the horse by the Utes of Utah was characteristic of the eighteenth and early nineteenth centuries.

The Utes were in a favorable position during the time that New Mexico was ruled by the Spanish, 1598-1821. The northward thrust of their empire reached but did not enter very much of the Ute area of residence. Such areas of Ute residence as Abiquiu and Cimmaron were used as Spanish land, but because the Utes were usually part of an alliance which made their contacts with the Spanish desirable, they did not resist this situation.

HISTORICAL SETTING AND INITIAL SPANISH PENETRATION

Among the various bands of Utes residing in Utah and Colorado, a small band called the Uintah-ats occupied the Uinta Basin initially (see map, page 7). Further east were the Yamparika and Parianuche (now White River); further west were the Tumpanuwache and the Cumumbas (now Uintah). To the south and southeast were the Tabeguaches and Sheberetches (now Uncompahgre).

The first contact between the Utes and the Europeans came in the early years of the eighteenth century as Spanish traders from New Mexico entered the central Rockies and the Great Basin in search of pelts and slaves.


UINTAHATS
YAMPARIKA
(White Rivers)
HUNTING GROUND
TUMPANUWACHE
WEEMNUCHE
PARIANUCHE
HUNTING GROUND
PAHVANT
UNCOMPAHGRE
(Tabegauches)
CAPOTE
MUACHE
HUNTING GROUND

APROXIMATE LOCATION OF BANDS

Source: Floyd A[illegible]cil

It is unlikely that these traders reached the Uinta Basin until the latter part of the century. Since this trade was declared illegal by Governor Juan Ignacio Mogollon in 1712 and was therefore done clandestinely, records are understandably scarce. Nevertheless, evidence does exist of small scale but periodic incursions into the southern portion of Ute territory by Spanish traders throughout the eighteenth century.[5]

In attempting to prohibit trade with the Utes, the Spanish authorities recognized that traders, opportunistic by nature and purpose, were unlikely to make a favorable lasting impression on the Indians. For such a delicate task as this, men of God were the only fit emissaries. Consequently, when the first official Spanish thrust was made through the vast Ute country in 1776, it was made under the leadership of two Franciscans, Fray Francisco Atanasio Dominguez and Fray Silvestre Velez de Escalante. This was the first Spanish party of record to reach the Uinta Basin.

The purpose of the Dominguez-Escalante expedition was twofold: to find a northern route from Santa Fe to the newly founded capital of Alta California (Monterrey), and to lay the groundwork for the establishment of a string of missions throughout the Ute domain. Although it was not successful in either aim, the expedition has taken its rightful place as one of the truly heroic and significant explorations in the history of the American West.[6]

The Domingqiz-Escalante expedition passed through the Uinta Basin from east to west in mid-September. This portion of their trek was covered without particular difficulty or incident, due in no small measure to the services of a Ute guide who had joined the party at San Antonio Martir in present-day west-central Colorado.[7]

After the Dominguez-Escalante trek through Ute lands, pressure to visit and trade grew stronger. But Spanish officials, continuing to fear that unrestrained trade would provoke hostility and war from the Indians, remained adamant. Incidents of violation became increasingly common; men were apprehended and tried for illegal trade in 1783, 1785, and 1797. Ironically, with the advent of the nineteenth century and the sudden threat of American encroachment into the continent's western regions, the Spaniards relaxed their restrictive policy and even encouraged trade with the Indians in hopes of securing their friendship.[8] But it was too late. The days of Spanish influence were clearly numbered.

THE ERA OF THE TRAPPERS

The first significant use of the Uinta Basin by whites was in the 1820s when fur trappers and traders came from the east and south.[9] Etienne Provost was in Utah in 1824 on a trapping expedition and may have entered the Uinta Basin. Provost, and indeed many men of French ancestry, were more welcome in Mexico's territory than those from the British Isles because they were Catholic.

The Anglo-Americans (those Americans with origins in Northern Europe were termed by the Mexicans "Anglos") came into Utah almost simultaneously with the New Mexico-based Americans and their Spanish-speaking fellows The Missouri-based Anglo-Americans entered the Uinta Basin in 1825 under the command of William Henry Ashley. There Ashley and his men met Etienne Provost, who helped the Ashley party to the Weber River. Ashley's men trapped the basin in subsequent years along with the trappers from New Mexico The area was heavily used. Weber reports:

> In 1831, for example, Denis Julien, a trapper who had been in the employ of Francois Robidoux in 1827, inscribed his name on a rock near the Uinta. Along a route that trappers would take to Fort Robidoux (in the Willow Creek drainage, south of Ouray, Utah), carvings on a cliffside reveal the names of Juan Valdes, 'B. Chalifou' (who must be Jean Baptiste Chalifoux), and F.R.B., and a name that looks like 'Acosta.' All were carved in May, 1835.[10]

Kit Carson was often in the country. He trapped on the Green River in 1831, spent the winter near Ouray in 1833-34, and was there at least twice in the 1840s.[11]

Antoine Robidoux constructed Fort Robidoux or Fort "Uinta" near the present site of Whiterocks in the winter of 1837-1838. The Robidoux brothers had traded in the area before that time and had established two forts in the Ute territory, one on the Uncompahgre River in Colorado and the other in present-day Uintah County. The post became a mecca; not only was it the first year-round white settlement in Utah, but it was the only place of white habitation in a vast domain.[12] Many famous visitors came: Marcus Whitman and Joseph Williams of Oregon fame, Rufus B. Sage, John Charles Fremont, and a long roster of those who were engaged in the fur trade.

Almost forgotten is a trail from Oregon to Santa Fe which was used by Whitman and Williams on their return to the United States in 1842. Williams left a short description of Utah's first settlement as they passed through.

> We reached the fort about 2 o'clock (July 10, 1942). We had to wait there for Mr. Robidoux about eighteen days, till he and his company and horse drivers were ready to start with us for the U.S. This delay was very disagreeable to me, on account of the wickedness of the people, and the drunkenness and swearing, and the debauchery of the men among the Indian women. One morning I heard a terrible fuss, because two of their women had ran away the night before. I tried several times to preach to them; but with little if any effect.

> Mr. Robidoux had collected several of the Indians squaws and young Indians to take to New Mexico, and kept some of them for his own use. The Spaniards would buy them for wives. This place is equal to any I ever saw for wickedness and idleness. The French and Spaniards are all Roman Catholics; but are as wicked men, I think as ever lived. No one, who has not, like me, witnessed it, can have any idea of their wickedness. Some of these people at the Fort are fat and dirty, and idle and greasy. [13]

Probably a less prejudiced view of Fort Robidoux was left by Rufus B. Sage:

> Robidoux's Fort is situated on the right bank of the Uintah...The trade of this post is conducted principally with the trapping parties frequenting the Big Bear, Green, Grand, and the Colorado rivers, with their numerous tributaries, in search of furbearing game. A small business is also carried on with the Snake and Utah Indians, living in the neighborhood of this establishment. The common articles of dealing are horses, with beaver, otter, deer, sheep and elk skins, in barter for ammunition, fire-arms, knives, tobacco, beads, awls, etc. The Utah and Snakes afford some of the largest and best finished sheep and deer skins I ever beheld,--a single skin sometimes being amply sufficient for common sized pantaloons. These skins are dressed so neatly as frequently to attain a snowy whiteness, and possess the softness of velvet. They may be purchased for the trifling consideration of eight or ten charges of ammunition each, or two or three awls, or any other thing of proportional value. Skins are very abundant in these parts, as the natives, owing to the scarcity of buffalo, subsist entirely upon small game, which is found in immense quantities. This trade is quite profitable. The articles procured so cheaply, when taken to Santa Fe and the neighboring towns, find a ready cash market at prices ranging from one to two dollars each. [14]

The fur trade of the mountains was a prosperous enterprise for approximately twenty-five years. As the prices of fur declined in the 1840s, the Ute Indians were paid less for their furs; consequently relations with the fur trappers became strained. In 1844 the Utes burned Fort Robidoux, hastening the decline of interest in fur trapping.[15] Following closely on these events war broke out between the United States and Mexico. The general disruption that attended the Mexican War destroyed all remaining trade systems.

By the time the war was over, permanent white settlement of Utah had begun.

CREATION OF THE UINTAH AGENCY AND THE PERIOD OF UTE REMOVALS

The Mormons completed their initial trek to the Great Basin in 1847, and their impact upon the Ute lands was enormous and permanent. Although the Mormons did not enter and explore the Uinta Basin until August, 1861, their presence along the Wasatch Front in central Utah was felt immediately by the Utes in the area. As the concentration of new settlers grew, Indian people were displaced and began raiding the farms and ranches. The first armed conflict to beset the new settlers in Utah was an extension of the struggle for food. The Walker War, fought between the Mormon and the Tumpanuwache Utes, lasted for only a few months. The Utes were defeated and sued for peace in 1854.

The white settlers looked for a more permanent solution to the problem.[16] In 1860, several communications with Washington, D.C., indicated the desire of the residents to have the Indians moved to a reservation. The Indian Agent for Utah in 1861, Henry Martin, recommended that the "Uintah Valley" (i.e., Uinta Basin) be made into a reservation. Before agreeing to this decision, Brigham Young sent an exploring party to the basin. The group reported unfavorably on the area's potential for further Mormon expansion:

> The exploring and surveying party...have returned with a very unfavorable report....The fertile vales, extensive meadows, and wide pasture ranges so often reported to exist in that region were not found....The amount of land at all suitable for cultivation is extremely limited.

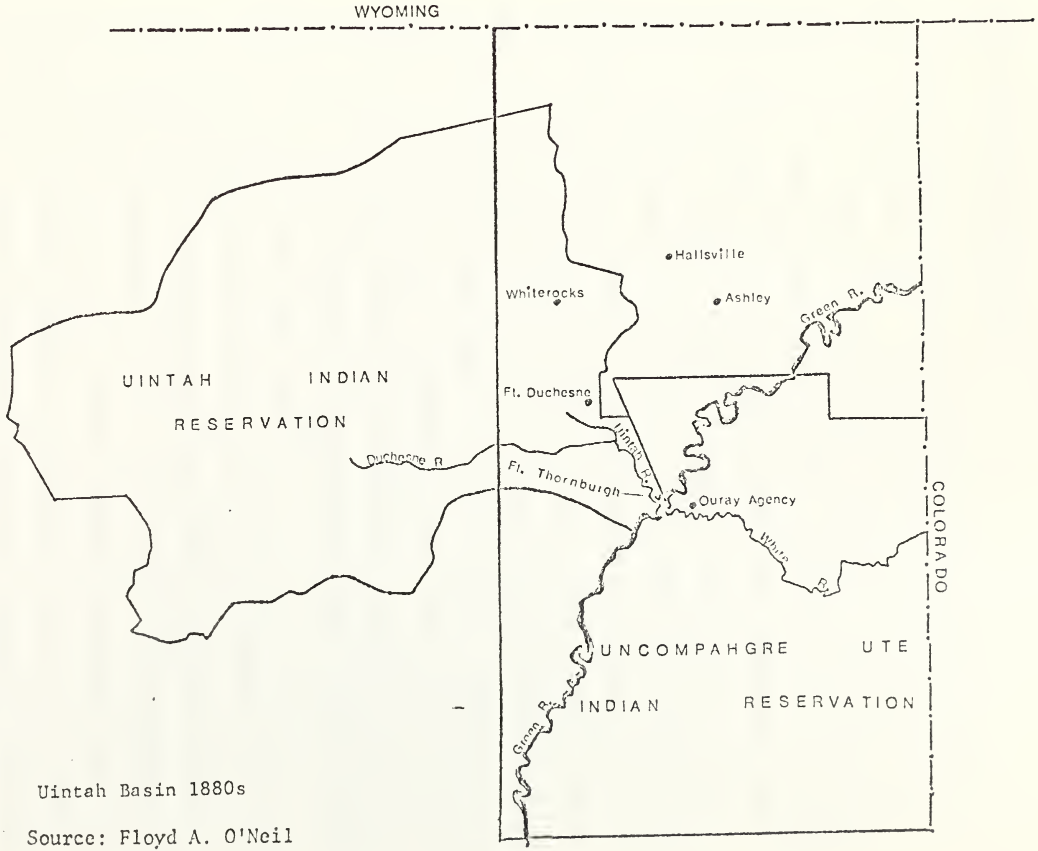
Following the Mormon rejection, Martin telegraphed his recommendation to the Commissioner of Indian Affairs, and the reservation was established by

Executive Order of President Abraham Lincoln on October 3, 1861. Congress confirmed the designation in May 1864.

The reservation was officially established but the Utes of central Utah (Tumpanuwache band) resisted removal to it. Unlike their kinsmen, the Uintah-ats, they were not charmed by the Uinta Basin, finding it much colder in the winter and generally less productive then the familiar valleys of the Wasatch Front and the Wasatch Plateau. Despite appeals from government officials, these Utes continued firm in their refusal to go. In the meantime, white population intensified and the competition for food reached a crisis. Violence erupted into a new war--the Black Hawk War--which was fought in periodic skirmishes from 1864 to 1869. During the course of the fighting, negotiations on the issue of removal continued. Superintendent of Indian Affairs for Utah, O. H. Irish, and Brigham Young carried on treaty talks with the Utes in June 1865, at Spanish Fork. By the terms of the treaty, the Utes would occupy the Uinta Basin in return for money, supplies, schools, and government assistance. But the treaty was not ratified by the U.S. Senate, and the war dragged on.

Finally the Indians were defeated; under a new leader, Tabby-to-Kwana (child of the sun), they agreed to removal. The new reservation included a western portion of what is now Uintah County, but it was largely made up of present-day Duchesne County (see map, page 14). The first two attempts to found an agency were in Duchesne County, but the final place chosen was Whiterocks in the western portion of Uintah County.[18] Tumpanuwache, Pah Vant, and Uintah-at bands occupied the area at that date.

The first three agents were unable to succeed in creating order and progress among the defeated and demoralized Utes. In February, 1871, John J. Critchlow arrived to take control. He was a man of great resolve and


WYOMING
COLORADO
UINTAH INDIAN RESERVATION
UNCOMPAHGRE UTE INDIAN RESERVATION
Hallsville
Ashley
Whiterocks
Ft. Duchesne
Ouray Agency
Ft. Thornburgh
Green R.
Uintah R.
Duchesne R.
White R.

Uintah Basin 1880s

Source: Floyd A. O'Neil

worked with skill and determination for more than twelve years. At the end of his term in office, the Uintah Agency was a permanent and viable institution.

CREATION OF UINTAH COUNTY AND EXPANSION OF THE RESERVATION

During Critchlow's tenure at the Uintah Agency, Mormon settlement expanded into the Uinta Basin. One of the first Mormon communities there was the Ashley settlement (Vernal area). The Ashley Valley already had a few settlers when the Mormon group arrived. Pardon Dodds, who had served as the first agent of the Uintah Agency in 1869, had established a ranch there in 1873. William S. Powell, an important cattleman in the early years of Uintah County, was also there. A few others had drifted in, but the familiar pattern of Mormon settlement was clearly visible in 1877 and 1878.[19] The new settlers had a difficult time in 1879 and 1880. Grasshoppers nearly ruined the crops in the summer; the winter was so cold and the snow so deep that stock froze to death and emergency parties had to be sent out to bring in food. Nevertheless, by 1880 several dozen families had moved into Ashley Valley, and the territorial legislature recognized the success of the settlement by creating Uintah County. Uintah included Daggett County as well at that time.[20]

In that same year, the neighboring White River (Yamparika) Ute Indians in Colorado rose in rebellion against their agent, killed him and part of his staff, and fought the U.S. Army, causing general alarm throughout that area. After the uprising was quelled, the people of western Colorado demanded that the Utes be expelled. Accordingly, in 1881 several hundred Colorado Utes (Yamparika band) were transferred, with most of them going to Uintah County. In the same year the federal government established a

new reservation for the Uncompahgre band of Utes who were also expelled from Colorado, even though this band was not guilty of any violence. The Uncompahgre Utes were given a major portion (approximately one-half) of Uintah County as their reservation.[21] (See map, page14).

With the influx of the new Indian population, the federal government decided to found a military post. The original site chosen was at the present location of Ouray and was called Fort Thornburgh in honor of the commander of the U.S. troops who had been killed by the White River (Yamparika) Utes two years earlier in Colorado. This placed the troops immediately across the river from the Uncompahgre Utes, but due to the lack of forage and the fact that the agent at the new agency considered the soldiers a moral threat to the Indians, the decision was made to move the fort to Ashley Creek. Fort Thornburg survived only three years. It was never very important to either the Indians or the settlers on Ashley Creek.[22]

The new Uncompahgre Ute Reservation was remarkably unsuited as a habitation for the newly dispossessed Utes. Their homeland had included the high San Juan Mountains in southwestern Colorado. To be moved to the barren desert from their former surroundings spelled certain failure in the government's attempt to make farmers of the Utes. The contrasts in the terrain and the attendant life styles were simply too great to allow for such an abrupt transition.

Neither the White River nor the Uncompahgre Utes who were transferred from Colorado were pleased with their situation. Further, inter-group strife erupted between the Utes. This, coupled with the increase in white settlement, prompted the War Department to found a new fort. Fort Duchesne was founded in 1886 by Major F.W. Benteen, of fame in the Custer affair ten years earlier. The fort, which was planned to be located on the Duchesne

River, was misplaced on the Uinta River, but the site selected was a good one.

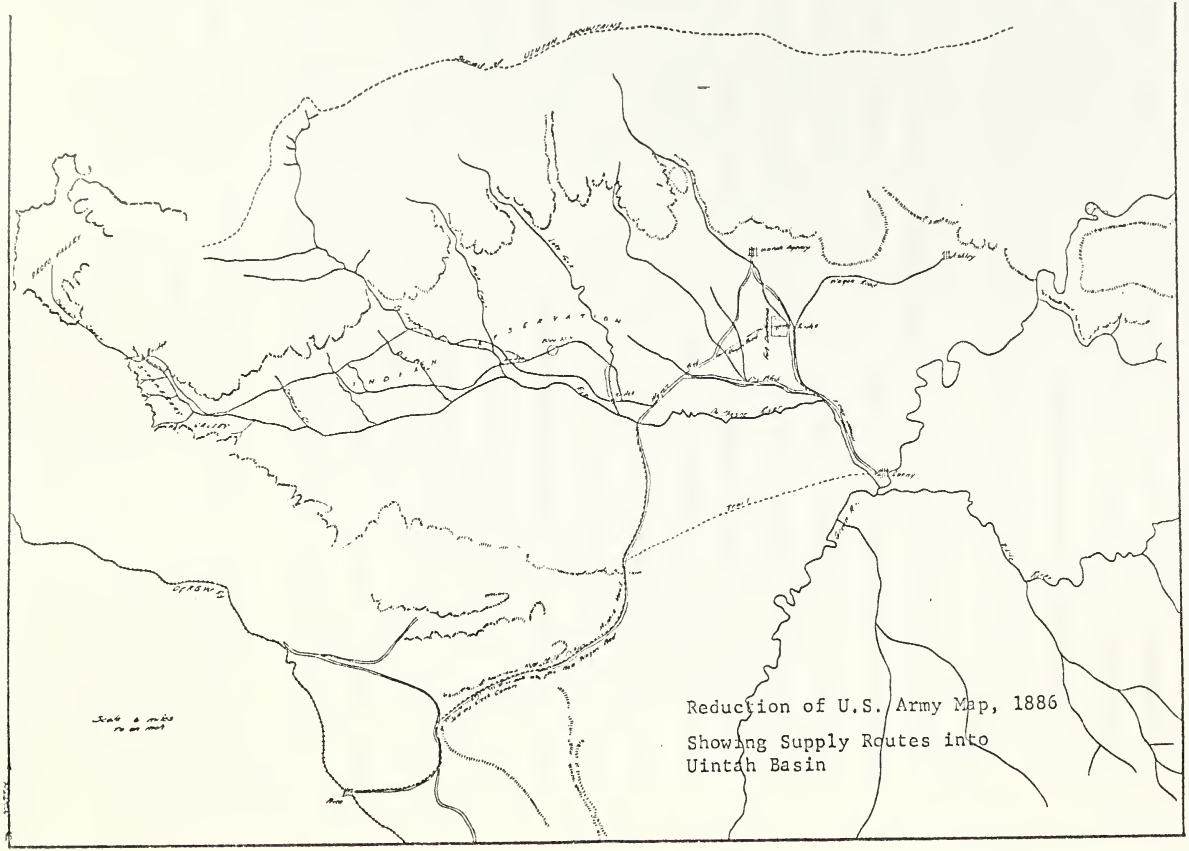
EARLY WHITE SETTLEMENTS, GILSONITE, AND OPENING OF THE UNCOMPAHGRE RESERVATION

With the area secure under the aegis of U.S. soldiers, the settlements grew rapidly. Along with the growth of Vernal, the county seat, several settlements grew at a slower pace: Naples, Maeser, Jensen, Hallsville, Glines Ward, and other small farming and ranching settlements. The Ashley settlements soon developed the characteristic Mormon pattern of one larger town in the valley, surrounded by smaller towns which used the central one as the cultural, religious, and economic center.

The Mormon wards were developed to conform roughly with the political boundaries. A stake of the Church of Jesus Christ of Latter-day Saints was founded at Vernal on July 13, 1886, dividing Wasatch Stake at Heber, Utah, to complete the new ecclesiastical division. The founding of enough wards to provide the status of a "Stake of Zion" gave the residents a certain acknowledgement of their success in settlement.

The remoteness of the area historically has made transportation a major problem for communities within the Uinta Basin. Settlers in the 1870s used the tortuous road over the Uinta Mountains to Fort Bridger, served by the Union Pacific Railroad, for most of their freight and mail. A very long and rough road went from Salt Lake City to Provo to Heber City, thence over Daniel's Summit into the Uinta Basin by way of the Duchesne River (see map, page18).

In 1881 the U.S. Army improved the road from Park City to Fort Thornburgh as a supply route. Also in that year, an improved route over the Uinta Mountains was built by Judge William A. Carter and the U.S. Army. Judge Carter and General Crook worked jointly, and army crews labored on



UINTAH MOUNTAINS
PROVO VALLEY
INDIAN RESERVATION
Trail
Wagon Road

Reduction of U.S. Army Map, 1886

Showing Supply Routes into
Uintah Basin

the road in 1882 and 1883. The high elevation across the Uinta Mountains made the road virtually impassable much of the year.[24]

The army again helped to build a route into the Uinta Basin in 1886. This new wagon road led from Price, a new station on the Denver & Rio Grande Western Railway. It was built and improved to provide access to the newly-founded Fort Duchesne. For many years this route was used for mail.

Important changes came to Uintah County with the discovery of a hydrocarbon called gilsonite. Although the presence of gilsonite was well known in the 1870s, it was not until the 1880s that two promoters, Sam Gilson and Bert Seaboldt, publicized the material and found uses for it. To their dismay, the developers realized the find was on the Uintah Indian Reservation when Agent T.A. Byrnes ordered them to leave. They then appealed to Congress for relief, and on May 24, 1888, Congress removed a triangular parcel of land of about 7,000 acres, later called the "strip", from the eastern border of the reservation. The removal required payment of $20 per acre and the approval of the Utes. Reports circulated that the Indians were bribed with trinkets and whiskey so they would approve the agreement; nevertheless, in September, 1888, the first portion of the reservation was removed from Indian control. As this land was being acquired, larger veins of gilsonite were being discovered on the Uncompahgre Reservation to the southeast.

The strip began only one mile northeast of Fort Duchesne. The first of the mining camps was built there. Stories still abound of the lawlessness and immorality of the place. It was federal territory again but not under the jurisdiction of territorial or county officials. The only federal officials in the area were restricted to military posts or Indian reservations.

Major James Randlett referred to the strip as the "location of a tough class of squatters. Men and women without means of existing except gambling, selling whiskey to Indians and prostitution." [25] The lonely soldiers at Fort Duchesne only one and one-half miles away were often in trouble for spending time there. At least ten murders were committed there in the first few years.[26]

In the early 1890s demand for gilsonite for use in varnish, paint, and casting soon grew to 300 tons of ore per month, most of which was taken to Price, Utah, by wagon to be shipped on the railroad.

The discovery of the largest of all the gilsonite veins, the "Cowboy Vein" in the White River area, caused great excitement, with the people of Uinta Basin expecting it to bring a large influx of population and a railroad. Once again the ore was on Indian land. During the 1890s the people of the area sent constant requests to Congress and the Secretary of the Interior for the opening of the Uncompahgre Reservation. Benjamin Harrison's Secretary of the Interior, John W. Noble, and Grover Cleveland's appointee, Hoke Smith, refused to open the reservation. Secretary of the Interior Smith, a Democrat, was a great disappointment to the people of the Uinta Basin, and they celebrated his leaving office in 1896, shortly before the end of the Cleveland administration. His successor, D.R. Francis, had insufficient time to deal with the problem.

The rights of the Indians to the minerals was only a minor problem to the residents of the Uinta Basin, but to the federal officials it was a serious matter of dispossessing the Indians of land which had been given to them only a few years earlier. Further, the Indians and the personnel of the Bureau of Indian Affairs were adamant that no more mineral exploitation

be allowed at the expense of the Indians. Nevertheless, as early as 1895, Indian Agent for the Uintah-Ouray Agency, James F. Randlett, received instructions from the Secretary of the Interior to begin allotting land to those Indians who wanted farms in preparation for the eventual opening of the Uncompahgre Reservation to white settlement. This was done under provisions of the Dawes Severality Act of 1887 which envisioned the allotment of individual tracts of reservation land to Indians for use as farms. Secretary Smith could not have conceived that in two million acres, less than ten percent of this tiny band of Indians could be allotted individual farms. The land simply was not agricultural. When it was finally seen that it was totally impossible to assign farms to the luckless Uncompahgres, the lands of the Uintah Reservation were opened to them. The Uintah Utes naturally reacted strongly to the loss of their lands to other Indians. The reluctant Uncompahgres were to pay $1.25 per acre to the Uintahs, which they naturally objected to doing. The agents and representatives of the government were upbraided and cursed by the ill-treated Indians, but to no avail. The government had its way; the allotments were to be completed by April 1, 1898, and all land not allotted was to be opened for settlement.

Ironically enough, the gilsonite lands were reserved by the federal government until it could be determined how to dispose of them to the advantage of the government. The eager miners were not to get into the veins on the former Uncompahgre Reservation until 1903. At that time one-half of the total area was opened. Claims for ore were allowed only in odd-numbered sections. Claims made a decade earlier were recognized and the rest sold. Much fraud and litigation accompanied the opening of this land, located in the general area of present-day Bonanza, Utah. As the Indians were dispossessed, there were scattered incidents of violence, but most of the rancor

was taken out in bitter denunciation of white men and their sense of justice. The military force at Fort Duchesne was too strong for armed protest.

The excitement over the opening of the Uncompahgre Indian lands to mineral development, plus the opening of small mines on the Colorado side of the border, led to investigations of the possibility of a railroad. The largest of the mining companies, the Gerneral Asphalt Company, or as it was usually called, the Barber Asphalt Company (Barber was a principal owner), began a survey in 1903 to determine if a railroad could be brought over the Book Cliff Mountains from Grand Junction, Colorado, to the new mineral developments. Using an old wagon road part of the way, the survey showed that construction of the road was possible but that it would be difficult to maintain.[27]

The Uintah Railway Company was founded in November, 1903. It was a Colorado corporation and several of the principals were closely connected to the Denver & Rio Grande Western Railway with which line the Uintah was to connect. Most of the rails, ties and rolling stock were purchased from D&RGW. The rails were mostly used ones which had been torn up from an abandoned D&RGW track. The line was only 55 miles in length, and proved extremely slow and difficult to operate. Because of the remoteness of the mines and the value of the ore being shipped, however, the Uintah Railway was an economic success. The cost of building and equipping the line was about $1.750,000.

As soon as the Uintah Railroad was finished in 1904, the Uintah Railway Company took its crews and began building bridges, roads, and ferries to connect its north terminus at Dragon, Utah, to Vernal and Fort Duchesne via toll roads. The roads were completed in 1905. The company charged

from $2.50 to $3.50 to use the toll roads from Vernal or Fort Duchesne to Dragon, the railhead. It operated horse-drawn stage coaches along the line, but these were changed to motor cars later in the line's history.[28] A man named Joe Goff built ferries across the Green River near Ouray and at Alhandra, a few miles south of Jensen, Utah.

Freight, toll, and passenger stations with telephone and telegraph service were inaugurated at Ignacio, Bonanza, Kennedy's Hole, Alhandra, Chipeta, and Ouray. These stations were usually operated by one family.

As the new railhead proved to be a success, especially with the connecting stagecoach line, the mail contract went to the Uintah Railway Company, and the Price Wagon road was no longer used for that purpose again, although a great volume of freight continued to be hauled over the route.

OPENING OF THE UINTAH RESERVATION AND CREATION OF DUCHESNE COUNTY

The Dawes Severalty Act of 1887 signified a major change in governmental Indian policy. Its aim was to encourage Indians to become farmers by giving them ownership of individual tracts of land allotted from reservation lands, thereby ending tribal existence. After allotment had been made to Indians, the remainder of the reservation was opened to white settlement.

The Uncompahgre land was lost early, but the pressure of white population caused the government to begin the process of opening the Uintah Reservation in the late 1890s. The Uinta and White River band protested, but the federal officers went ahead with land and water surveys. The Indians were then asked to vote to allow their reservation to be opened. They steadfastly refused. In desperation, the Commissioner of Indian Affairs sent his best negotiator, James McLaughlin, to deal with them. In a series of meetings at Whiterocks in 1903, McLaughlin failed, even though he resorted

to bribery and to counting the votes of children.

Congress then took the situation in hand and passed an act opening the reservation in spite of the Ute attitude. President Theodore Roosevelt proclaimed the Uintah Reservation open to white settlement on July 14, 1905. There had been only a few settlers on the Uncompahgre land, but a flood came to the new lands of the Uintah Reserve. The northern end of the reservation, on the south face of the Uinta Range, was made a part of the Ashley National Forest.

The Indians were outraged. In 1906 some 700 of them left the reservation area and traveled to South Dakota where they attempted to make an alliance with the Sioux. The Sioux, defeated at Wounded Knee in 1890,were in desperate poverty and too poor to offer the Utes hospitality. In 1908 the dispirited Utes were escorted home by the army. So forcefully was the truth of their defeated condition driven home that by 1912 the U.S. Army could abandon Fort Duchesne. The Utes were then forced to deal with civil authorities.[29]

As the opening of the reservation was a disaster to the Utes, it was a boon to many land-hungry whites. By the fall of 1906, more of the Uinta Basin than could be farmed had been taken as homesteads by the new influx. The abandonment rate was very high in subsequent years. But initially towns and small farming communities were rapidly born. Uintah, Lapoint, Tridell, Bennett, Leeton, Alterra, Independence, Wilson, and later Ballard were founded immediately after the opening of the reservation, and Leota was founded in 1917; three settlements established by the federal government--Fort Duchesne, Randlett, and Ouray--all experienced population growth.

The expansion into present-day Duchesne County was even more rapid. New communities at Alonah, Antelope, Midview, Arcadia, Bryant, Bonita, Bluebell, Blumesa Crescent, The Basin, Cedarview, Montwell, Monarch, Cataract, Duchesne (at first Theodore), Fruitland, Hayden, Hanna, Harper (now Nine Mile), Hartford, Hyland, Ioka, Juanita, Lakefork, Mt. Emmons, Mountain Home, Myton, Neola, Palmer, Roosevelt, Tabiona, Talmage, Utahn, Woodbine and Deep Creek were built in the first decade after 1905. So rapid was the growth that the Mormon church was able to establish a stake in 1910. In nearly all of the farming communities, church wards or branches were organized.[30]

The State Legislature created Duchesne County from part of Wasatch County in 1915. A struggle ensued over the location of the county seat among Roosevelt, Myton and Duchesne. In a political trade-off, Duchesne was named county seat and Roosevelt was to get the first high school. Roosevelt and Duchesne have become the centers of commerce for the county. The county's economy soon developed around farming, grazing, government employment, and some mining, especially gilsonite.

Because of the distances involved to markets and to centers of commerce, transportation has been and is an unusual part of the economy of Duchesne and Uintah counties. The farms have not tended to be single cash crop units, but usually diversified family farms with stock raising, principally cattle, sheep, and hogs, as an important part.

PRESENT UINTAH-OURAY RESERVATION

The Uintah-Ouray Agency was created when the administration of the two reservations (Uintah and Uncompahgre) was combined in 1886. The area has been dealt with as one unit since 1905.

Presently the Uintah-Ouray Reservation is comprised of 1,008, 128 acres of land, of which 37,855 are allotted. These are administered by the federal government as lands held in trust.

In recent years, the tribe has sponsored the building of a great number of new homes. Although housing was substandard through most of the reservation years, new construction is now dealing with that problem. Cultural and recreational facilities exist in the three largest communities: Whiterocks, Fort Duchesne, and Randlett.

The Utes remain interested in hunting, fishing and outdoor sports. The reservation is an ideal spot for these activities. Additionally, tourism is a growing aspect of the economic interests of the Ute tribe. With federal assistance, the tribally-owned resort, Bottle Hollow, has been constructed and in operation for three years; it is presently being expanded. The tourist complex represents a source of employment for Ute people. In addition, the tribe owns a furniture and cabinet factory, Ute Fab, Ltd, which is one of the largest employers in the area. The tribal cattle enterprise is another source of income. Oil and gas leases, mineral leases, and the rental from tribal agricultural and grazing lands all add to the income of the tribe.

The tribe welcomes visitors to the reservation. Information concerning rules can be obtained at the tribal office or at Bottle Hollow Resort.

HISTORICAL SUMMARY OF SURVEY TRACTS U-A AND U-B AND DESCRIPTION OF HISTORIC SITES

The survey area of the oil shale lease lands encompasses tracts U-a and U-b (See map, page 31) and a ca. one mile wide buffer zone. These tracts were part of the area originally occupied by the Utes; they were taken from the Indians in a treaty (never ratified) signed at Spanish Fork, Utah,

1865. The land was part of the public domain until 1882 at which time it was made a part of the Uncompahgre Reservation by an Executive Order of January 5 that year. This document is quoted as follows:

> Uncompahgre Reserve
>
> EXECUTIVE MANSION, January 5, 1882
>
> It is hereby ordered that the following tract of country, in the Territory of Utah, be, and the same is hereby, withheld from sale and set apart as a reservation for the Uncompahgre Utes viz: Beginning at the southeast corner of township 6 south, range 25 east, Salt Lake meridian; thence west to the southwest corner of township 6 south, range 24 east; thence north along the range line to the northwest corner of said township 6 south, range 24 east; thence west along the first standard parallel south of the Salt Lake base-line to a point where said standard parallel will, when extended, intersect the eastern boundary of the Uintah Indian Reservation as established by C. L. DuBois, United States deputy surveyor, under his contract dated August 30, 1875; thence along said boundary southeasterly to the Green River; thence down the west bank of Green River to the point where the southern boundary of the said Uintah Reservation, as surveyed by Du Bois, intersects said river; thence northwesterly with the southern boundary of said reservation to the point where the line between ranges 16 and 17 east of Salt Lake meridiah will, when surveyed, interest said southern boundary; thence south between said ranges 16 and 17 east, Salt Lake meridian, to the third standard parallel south; thence east along said third standard parallel to the eastern boundary of Utah Territory; thence north along said boundary to a point due east of the place of beginning; thence due west to the place of beginning.

Because the land was so unsuited to the uses of the Uncompahgre Utes, and because the land was deemed valuable for mineral deposits, a bill in Congress was enacted on August 15, 1894, to allot land to the Uncompahgres and to open the reservation to homestead and mineral entry. The allotment went very slowly, and the land was not placed back in the public domain until March 3, 1903. This act allowed claims only if they contained no asphalt, gilsonite, elaterite, or other like substance except in odd numbered

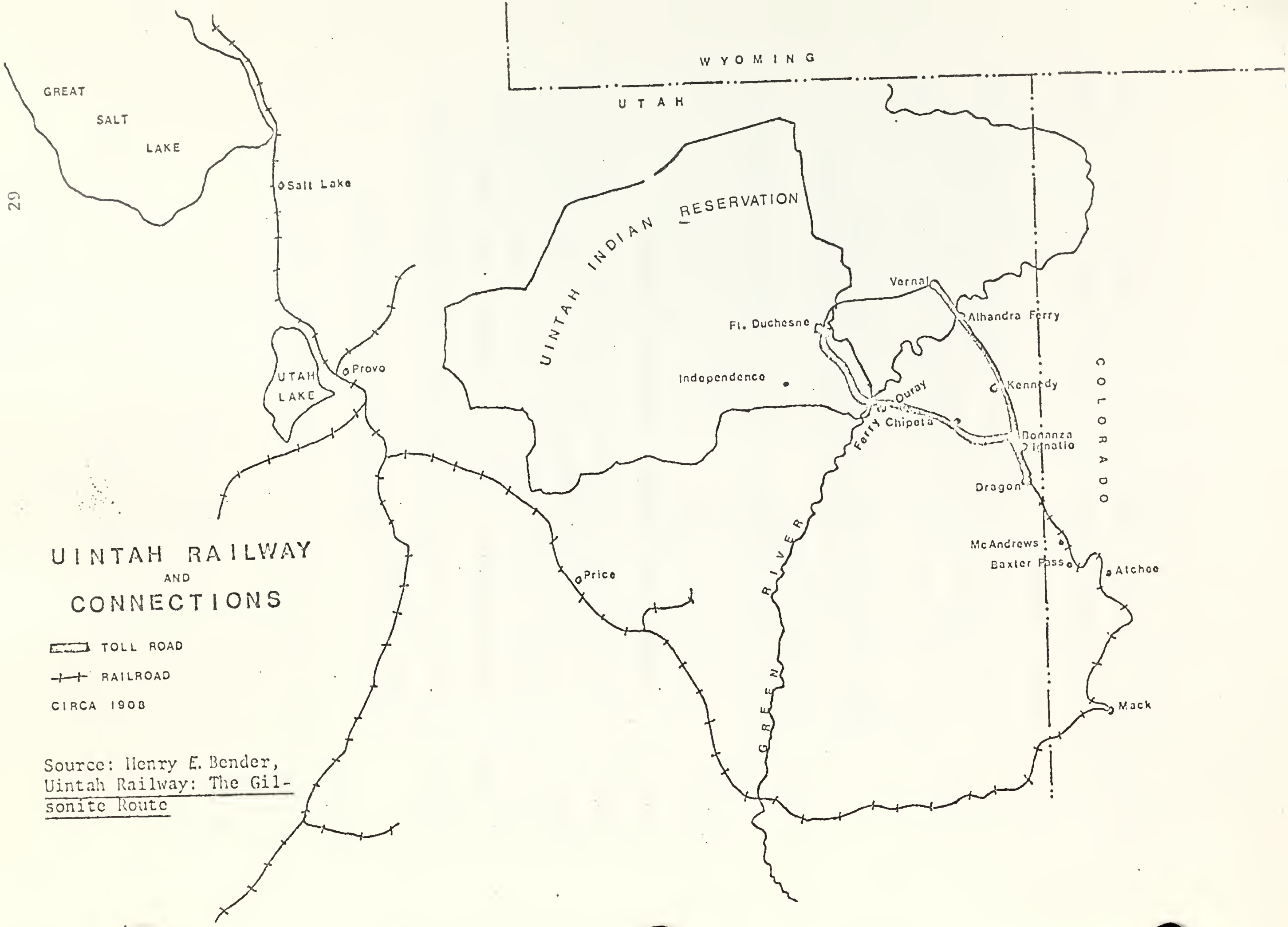
sections--so half of the area was opened and intense mining operations began. Not until 1951 was equitable payment made to the Utes through a U.S. Indian Court of Claims settlement.

Following the opening of the Uncompahgre Reserve, the newly available ore made building a railroad a viable option. Developers from the gilsonite companies and the Denver and Rio Grande Western Railway joined to build a independent line from Jack, Colorado, to Dragon, Utah, one of the newly opened mines. The same investors built telegraph and telephone lines to Vernal and Fort Duchesne as well as toll roads and stage lines to those points. The telegraph line and toll road were built across the eastern portion of the tract. The railroad terminus was more than a mile south of the tract. (See map, page 29.)

The first station north of Dragon was at Ignacio, on the White River. While the stage stop and bridge were being constructed, the stage went down Evacuation Creek, but it was necessary to ford the White River several times to get to Wagon Hound Cayon and the road. At Ignacio, several small buildings were built to accommodate a ticket office, dining room, bedrooms, and a corral and storage barn for a change of horses. In the 1920s, as the population intensified, a one-room school was operated there. But as automobile traffic removed the necessity for the stage stop, the school was abandoned.

Ignacio Stage Stop

The remnants of the Ignacio stage stop remain, but in poor condition. They are a good example of the type of architecture used in this part of the late frontier. The Bureau of Land Management is currently preparing documents asking that the area be preserved. The area to be preserved



UINTAH RAILWAY AND CONNECTIONS

TOLL ROAD
RAILROAD
CIRCA 1908
GREAT SALT LAKE
Salt Lake
UTAH LAKE
Provo
Price
GREEN RIVER
UINTAH INDIAN RESERVATION
Independence
Ft. Duchesne
Vernal
Alhandra Ferry
Ouray
Ferry
Chipeta
Kennedy
Bonanza
Ignatio
Dragon
McAndrews
Baxter Pass
Atchee
Mack
WYOMING
UTAH
COLORADO

Source: Henry E. Bender, Uintah Railway: The Gilsonite Route

would not be large.

A few homesteads were taken on Tracts U-a and U-b, but the locations were quite unfavorable to agriculture. The improvements may have been made in hope that minerals would later be found.

Site #1

In November 1923, George E. Pope was given a deed to Site 1 (see map, page 31):

> The north 1/2 of the NW 1/4 section 14, range 24 east,
> Salt Lake Meridian.

A cabin was built there in the early 1920s, made of cottonwood loss with no concrete or stone foundations. It fell into disrepair rather quickly and is now beyond repair. It has no aesthetic or historic value. The cabin is approximately 12 x 24 feet, has rough wood floors, and the roof is missing although it was probably made of boards covered with dirt. A stove was used rather than any masonry being put into fireplace or chimney.

Site #2

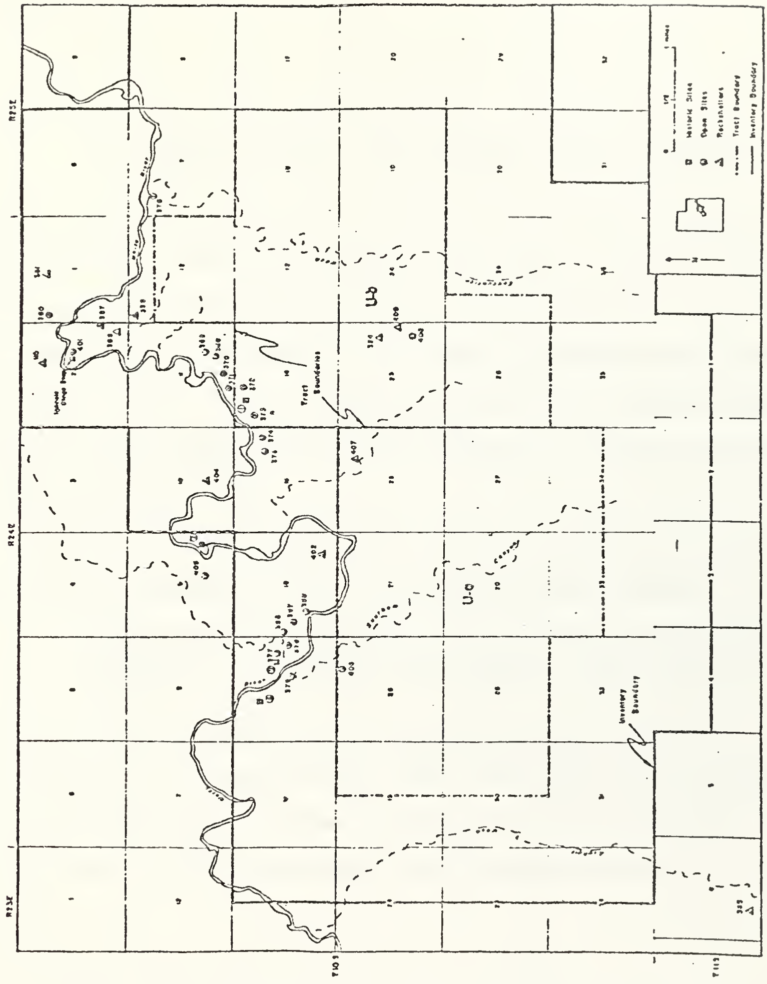
At Site 2 (see map, page 31) the land was deeded under homestead entry to Eugene Pope on May 18, 1923:

> The east 1/2 of the southeast quarter section of section 9,
> township 10 south, range 24 east, Salt Lake Meridian,
> Utah.

At this location small cabins were also built and some attempts at farming were made. Small acreages of alfalfa and grain were raised. Livestock was the most important part of the operation. The cabins are beyond repair and of no cultural interest.

In the case of both of these cabins, they were made of cottonwood logs, had board floors, windows of simple barn sash, no fireplaces and no foundations. The roofs were made of board covered with dirt (a kind of clay which

Location of Archeological and Historic Sites in and Adjacent to Tract Areas


Historic Sites
Open Sites
Rockshelters
Tract Boundary
Inventory Boundary
Tract Boundaries
Inventory Boundary
U-a
U-b
R23E
R24E
R25E
T10S
T11S

Source: Antiquities Section, Utah Division of State History

sheds water and is available in the area). They reflected a vernacular architecture common to the Uinta Basin. Better examples of this type are found elsewhere in the area.

Site #3

At Site 3 (see map, page 31) the land was deeded to Edwin J. Longhurst on November 5, 1921, under a homestead entry. The description is:

> The northeast quarter of the southeast quarter of section 17, township 10 south, range 24 east, Salt Lake Meridian.

At this location, cabins and corrals were built and some farming was done. The land appears adaptable to farming if the waters of the White River were to be controlled. The use of the site as a farm was not of long duration. The area is now used for grazing. The cabins are beyond repair and are of no cultural value. They had rough wood floors, and the roofs were probably made of boards covered with dirt. No fireplaces or chimneys were constructed; instead stoves were used.

Adjacent to this homestead was one given to Gerald Hunting, issued on the same day, November 5, 1921. This homestead entry contained:

> The east 1/2 of the NW 1/4 of the south 1/2 of the NE 1/4 of section 17 in township 10 south, range 24 east, Salt Lake Meridian.

Here,too, farming was done, but the area is now used for grazing. Cabins in extremely poor condition remain. These cabins were made of cottonwood logs, hard board floors, windows of simple barn sash, no fireplaces and no foundations. The roofs were made of board covered with dirt.

Site #4

At Site 4 (see map, page 31) the Ute Oil Company bought the land from the federal government sometime in the 1920s. It is not farming land.

Various owners have held it for mineral and oil exploration.

RECOMMENDATIONS

The area of the U-a and U-b tracts is not of great historical significance. The Ute Indians traversed the White River area, although no known trails are left, and a few allotments of land were made to Uncompahgre Utes up and down the White River from the tracts. None was made within the tracts themselves. The area was never a central camping ground or place of particular cultural interest to the Ute Indians. To the non-Indian population, the area was seldom sought for any purposes other than economic.

The lack of a hospitable environment has made the area marginally usable for agriculture, and grazing is good only along the White River bottoms; it is less valuable in the rest of the survey area. The relative unimportance of agriculture on the tracts is emphasized by the fact that less than 100 acres in the entire area was ever put into crops, and that abandoned after only a few years. The only fertile soil is along the river botton, and that area was subject to flooding in high water periods. It has been the mineral content of this land that has made it important to man. It is not capable of sustaining agriculture although it has some value for grazing.

The historical structures of the area worth saving are limited to the immediate area of the Ignacio Stage Stop. This complex has been certified as eligible for listing on the National Register of Historic Sites by the Utah State Historic Preservation Office, 603 East South Temple, Salt Lake City, Utah. That agency plans to present this nomination to the Governor's Review Committee in the very near future.

Footnotes

[1] A.L. Kroeber, Cultural and Natural Areas of Native North America, (Berkeley, California: University of California Press, 1947), p. 52; and R.H. Lowie, "Notes of Shoshonean Ethnography," Anthropological Papers of the American Museum of Natural History, Vol. XX (New York: American Museum of Natural History, 1924), p. 199.

[2] James W. Covington, "Relations Between the Ute Indians and the United States Government, 1848-1900," Unpublished Ph.D. Dissertation, University of Oklahoma, 1949, pp. 1-23.

[3] Julian H. Steward, "Native Cultures of the Intermontane (Great Basin) Area," Smithsonian Miscellaneous Collections, (Washington, D.C. G.P.O., 1940), p. 477.

[4] S. Lyman Tyler, "The Yuta Indians Before 1680," The Western Humanities Review, Vol. V (Spring, 1941), pp. 153-63.

[5] David J. Weber, The Taos Trappers: The Fur Trade in the Far Southwest, 1540-1846, Norman, Okl.: University of Oklahoma Press, pp. 23-26.

[6] Herbert E. Bolton, Pageant in the Wilderness: The Story of the Escalante Expedition to the Interior Basin, 1776, Salt Lake City, Utah: Utah State Historical Society, 1950.

[7] Ibid., pp. 46-62.

[8] Weber, Op. Cit., p. 28.

[9] LeRoy R. Hafen, "Mountain Men Before the Mormons," Utah Historical Quarterly. Vol. XXVI, No. 4(October, 1958), pp. 307-326.

[10] Weber, Op. Cit., p. 213.

[11] Leland Hargrave Creer, The Founding of an Empire: The Exploration and Colonization of Utah, 1776-1856, Salt Lake City, Utah: Bookcraft, 1947 (1959), p. 76.

[12] Weber, Op. Cit., p. 213.

[13] Creer, Op. Cit., p. 75.

[14] Ibid., p. 76.

[15] Weber, Op. Cit., pp. 215-16.

[16] Floyd A. O'Neil, "A History of the Ute Indians of Utah Until 1890," Unpublished Ph.D. Dissertation, University of Utah, 1973, Ch.3.

[17] Deseret News, Sept. 25, 1861.

[18] O'Neil, Op. Cit., pp. 89-99.

[19] Daughters of the Utah Pioneers of Uintah County, Utah, Builders of Uintah: A centennial History of Uintah County, 1872-1947, Springville, Utah: Art City Publishing Co., 1947, pp. 10-16.

[20] Ibid., p. 15.

[21] O'Neil, Op. Cit., Ch.7.

[22] Thomas G. Alexander and Leonard J. Arrington, "The Utah Military Frontier, 1872-1912; Forts Cameron, Thornburgh, and Duchesne," Utah Historical Quarterly, Vol. 32, No. 4 (Fall, 1964), pp. 339-354

[23] Daughters of the Utah Pioneers of Uintah County, Utah, Op. Cit., p. 15.

[24] A.R. Standing, "Through the Uintas: A History of the Carter Road," Utah Historical Quarterly, Vol. 35, No. 3(Summer, 1965), PP. 256-257.

[25] Newell Christy Remington, "A History of the Gilsonite Industry," Unpublished Master's Thesis, University of Utah, 1959, pp. 52-53.

[26] Ibid., p. 53.

[27] Henry E. Bender, Uintah Railway; The Gilsonite Route, Berkeley, Calif.: Harnell-North Books, 1970.

[28] Remington, Op. Cit., pp. 261-270.

[29] Floyd A. O'Neil, "An Anguished Odyssey: The Flight of the Utes, 1906-1908," Utah Historical Quarterly, Vol. 36, No. 4 (Fall, 1968),

[30] Daughters of Utah Pioneers, Early History of Duchesne County, compiled by Mildred Miles Dillman, Springville, Utah: Art City Publishing Co., 1948.

BIBLIOGRAPHY

Manuscript Materials

Bancroft, H. H. "Bancroft Scrapbook of Materials Collected in the Preparation of Various Pacific States Handbooks, 1860-64." (microfilm), Vols. 27 & 28 on Utah Counties.

Commercial Club, Vernal, Utah. "Available Land for the Homeseeker in the Great Uintah Basin, Northeastern Utah." Vernal Utah: Vernal Express Print, 191?.

Gates, Susan (Young). 1856-1933, "Utah Woman in Politics." 16p., n. p., n. d.

Historical Records Survey, Utah. "Inventory of the County Records of Utah, No. 24." Ogden, Utah: mimeographed, 1940.

Tyler, Samuel Lyman. "Yuta Indian Material in the Spanish Archives of New Mexico." n. p., n. d.

Writer's Program, Utah. Geological Wonders of Utah. (Salt Lake City: 1942), mimeographed, 78pp.

Newspapers

Deseret Evening News. Dec. 17, 1910. Sept. 25, 1861.

Roosevelt Standard. Roosevelt, Utah. 1955.

Salt Lake Tribune. Sunday Magazine Edition. Dec. 5, 1948.

Salt Lake Tribune. May 18, 1938.

Salt Lake Tribune. Sunday Magazine Edition. May 6, 1950.

Periodicals and Journals

Huff, Gerald A. "Mining an Unusual Mineral." Our Public Lands, Vol. 20, No. 2, (Spring, 1970).

Kay, J. LeRoy. "The Tertiary Formations of the Uinta Basin, Utah." Annals of the Carnegie Museum, XXIII (1934).

Periodicals and Journals

"Stanolind's Search for Oil in the Vast Uintah Basin." Utoco-Torch (October, 1952).

Works Progress Administration. Today's Work (1935).

Athearn, Robert G. "Opening the Gates of Zions Utah and the Coming of the U. P. R. R." Utah Historical Quarterly, Vol. 36, No. 4, (Fall, 1968).

Douglas, Earl. "Geological Trip into Uintah Basin." Salt Lake Mining Review, March 15, 1920 and April 30, 1920.

Emmons, S. F. "Descriptive Geology: U. S. Geological Exploration 40th Parallel." U. S. Geological Survey, Vol. 2.

"First Missionaries, Trappers and Traders of Uinta Basin." Utah Historical Quarterly, Vol. 9.

Hansen, Wallace R. "The Geologic Story of the Uinta Mountains." Geological Survey Bulletin 1291.

Kinney, D. M. "Geology of the Uintah Riverbrush Creek Area, Duchesne and Uintah Counties, Utah." U. S. Geological Survey Bulletin 1007.

Kneak, Albert H. "Uintah Basin and Its Irrigable Government Lands." The Railroad Red Book (January, 1917).

Marsh, O. C. "On the Geology of the Eastern Uinta Mountains." American Journal of Science, 3rd Series, Vol. I.

Owen, Tom J. "Land Management in Action . . . One District's Job." Our Public Lands, Vol. 12, No. 4 (April, 1963).

Palmer, Edward (ed.). "Notes on the Utah Utes," by R. F. Heizer. Anthropological Papers, No. 17 (1954).

Pedersen, Lyman C., Jr. "Early Penetration of the Uintah Basin." Journal of the West, Vol. II, No. 4 (October, 1972).

"Plans Studied for Prospecting 140 Mile Line Extention in Utah." Green Light, Denver and Rio Grande (May 1960).

Powell, J. W. "Report on the Geology of the Eastern Portion of the Uinta Mountains and a Region of County Adjacent Thereto." U. S. Geological and Geographical Survey Territories. Wash., D.C.: G.P.O., 1876.

Reagan, Albert B. "Summary of Archaeological Finds in the Uintah Basin in Utah." Utah Academy of Sciences Proceedings, Vol. X (1933).

Periodicals and Journals

Reagan, Albert B. "Anciently Inhabited Caves of the Vernal (Utah) District, with Some Additional Notes on Nine Mile Canyon, Northeast Utah." Transactions Kansas Academy of Science, Vol. 36 (1933).

______. "Some Notes on the History of the Uintah Basin in Northeastern Utah, to 1850." Proceedings of Utah Academy of Sciences, Vol. XI (1934).

______. "Forts Robidoux and Kit Carson in Northeastern Utah." New Mexico Historical Review (April, 1935).

Sears, J. D. "Yampa Canyon in the Uinta Mountains, Colorado." U. S. Geological Survey Professional Paper 374-1.

Standing, Arnold R. "Through the Uintas, History of the Carter Road." Utah Historical Quarterly, Vol. 35, No. 36 (Summer, 1967).

"The Uintah Land Opening." American Monthly Review of Reviews (July-December, 1905).

"Uinta Railroad (Uintah)." Colorado Magazine (May, 1935).

"Uintah Basin Rich in Pre-Historic, Ancient and Modern History." The Vernal Express, n. d., n. p.

"Utah Issue." Arizona Highways Magazine (1947).

Walhquist, Loreen P. "Memories of a Uintah Basin Form." Utah Historical Quarterly, Vol. 42, No. 2 (Spring, 1974).

Walton, Paul Talmadge. "Geology of the Cretaceous of the Uinta Basin, Utah." Structure of the Uinta Mountains. N.Y.: 1944.

Winchester, Dean E. "Oil Shale of the Uinta Basin, Northeastern, Utah, and Results of Dry Distillation of Miscellaneous Shale Samples." U. S. Geological Survey Bulletin.

Collett, R. S. "Roosevelt in the Uintah Basin." The Railroad Red Book (January, 1917).

Public Documents

U. S. Statutes at Large.

U. S. Government Documents. Serial Set.

Public Documents

U. S. Dept. of the Interior. Indian Lands Uintah Reservation, Utah. 57th Cong., 1st Sess., January 28, 1902, Sen. Doc. No. 154.

U. S. Dept. of the Interior. Opening of the Uintah Indian Reservation in Utah. 58th Cong., 2nd Sess., February 15, 1905, Sen. Doc. No. 159.

U. S. Dept. of the Interior, Surveys and Examinations of Uinta Indian Reservation. 57th Cong., 1st Sess., June 19, 1902, House Doc. No. 671.

U. S. Dept. of the Interior. Uintah Indian Reservation. 55th Cong., 1st Sess., April 13, 1897, Sen. Doc. No. 32.

U. S. Army Corps of Engineers, Report of the Exploring Expedition from Santa Fe, New Mexico, to the Junction of the Grand and Green Rivers of the Great Colorado of the West, in 1859, under the Command of Capt. J. N. Macomb, Corps of Topographical Engineers with Geological Report by Prof. J. S. Newberry. Wash., D. C., G.P.O.

U. S. BIA Planning Support Group. The Uintah and Ouray Indian Reservation: Its Resources and Development Potential.

Books and Pamphlets

Arrington, Leonard J. From Wilderness to Empire; The Role of Utah in Western Economic History. University of Utah Institute of American Studies No. I. Salt Lake City, Utah: Univ. of Utah, 1961.

Bancroft, Hubert Howe. History of Utah. Salt Lake City: Bookcraft, 1964.

Beal, Merrill D. Intermountain Railroads, Standard and Narrow Gauge. Caldwell, Idaho: Coxton Printers, 1962.

Beebe, Lucius. Narrow Gauge in the Rockies. Berkeley, California: 1955.

Bender, Henry E. Uintah Railway: The Gilsonite Route. Berkeley, California: Harnell-North Books, 1970.

Bilton, Ronald Davis. Diane's Autobiographies and Other Personal Documents in Salt Lake City Repositories. Salt Lake City, Utah, 1968, 2nd Ed. Salt Lake City: Univ. of Utah, 1971.

Blanch, George T. A Study of From Organizations by Types of Forms in Uintah Basin, Utah. Utah State Agricultural Experimental Station Bulletin 285, Logan, Utah: 1939.

Books and Pamphlets

Alter, J. C. In the Beginning. Salt Lake City.

_______. Utah, the Storied Domain, a Documentary History of Utah's Eventful Career, Comprising the Thrilling Story of Her People from the Indians of Yesterday to the Industrialist of Today. Chicago and New York: The Am. Historical Society, Inc., 1932.

Carter, Kate B., Compiler. Bibliography of Utah Writings and History. Salt Lake City (?): Utah Centennial Commissions, 1947.

_____, Compiler. Heart Throbs of the West. Salt Lake City: Daughters of Utah Pioneers, 1939-51.

_____, Compiler. Our Pioneer Heritage. Salt Lake City, Daughters of Utah Pioneers, 1958, Vol. I.

Creer, Leland H. The Founding of an Empire; the Exploration and Colonization of Utah, 1776-1856. Salt Lake City: Bookcraft, 1939.

Daughters of Utah Pioneers. Early History of Duchesne County. Compiled by Mildred Miles Dillman. Springville, Utah: Art City Publishing Co., 1948.

Daughters of Utah Pioneers. Uintah County. Builders of Uintah; a Centennial History of Uintah County, 1872 to 1947. Springville, Utah: Art City Publishing Co., 1947.

Dwyer, Robert Joseph. The Gentile Comes to Utah: A Study in Religious and Social Conflict (1862-1890). Salt Lake City: Western Epics (1971).

Fay, George E. Land Cessions in Utah and Colorado, by the Ute Indians, 1861-69. Museum of Anthropology, Miscellaneous Series, No. 13. Greeley, Colo." Univ. of Northern Colo., 1970.

Froiseth, Bernard Arnold Martin. Froiseth's New Sectional and Mineral Map of Utah. Salt Lake City: 1878.

Gillin, John Phillip. Archeological Investigation in Nine Mile Canyon. Salt Lake City: U of U Press, 1955.

Gottfredson, Peter. History of Indian Depredations in Utah. Salt Lake City: Press of Skelton Publishing Co., 1919.

Hafen LeRoy R. Old Spanish Trail: Santa Fe to Los Angeles. Glendale Calif.: A. F. Clark Co., 1954.

Harris, William R. The Catholic Church in Utah, Including an Exposition of Catholic Faith by Bishop Scanlan. Salt Lake City: Inter-Mountain Catholic Press, 1909.

Books and Pamphlets

Hunter, Milton R. Utah, the Story of Her People, 1540-1947: A Centennial History of Utah. Salt Lake City: Deseret News Press, 1946.

Jorgensen, Joseph Gilbert. The Sun Dance Religion; Power for the Powerless. Chicago: U of Chicago Press, 1972.

Judd, Neil Merton. Archeological Observations North of the Rio Colorado. Wash., D.C.: G.P.O., 1926.

Kneale, Albert H. Indian Agent. Caldwell, Idaho: Copton Printers, 1950.

Kretchman, Herbert F. The Story of Gilsonite. Salt Lake City, Utah: American Gilsonite Co., 1957.

Lambert, Roy. High Uintas, Hi! Kamas, Utah: The Author, 1964.

Livingston, E. Jeffery. Industrial Bibliography of Utah. Boulder, Colo.: Western Interstate Commission for Higher Education, 1969.

Lyman, June and Norma Denver, compilers. Edited by Floyd A. O'Neil and John D. Sylvester. Ute People, An Historical Study. Salt Lake City, Utah: Uintah School District and the Western History Center, University of Utah, 1970.

McConnell, Virginia. Ute Pass: Route of the Blue Sky People. Denver: Saga Books, 1963.

McLaughlin, W. W. Agricultural Reconnaisance of the Uintah Reservation, Utah State Agricultural College, Agricultural Experiment Station. [Bulletin No. 93], Logan: 1903.

Miller, David E. Utah Historial Atlas. Salt Lake City, Utah: 1968.

Mitchell, Ceanne. Uintah County, Utah: An Economic Study. Salt Lake City: Bureau of Econ. and Bus. Research, College of Business, Division for Economic Development and Research, Center for Economic and Community Development, Univ. of Utah, 1968.

Morgan, Dale L. Jedediah Smith and the Opening of the West. Lincoln, Nebraska: University of Nebraska Press, 1953.

Nelson, Roger H. A Tourist and Recreation Feasability Study of the Uintah and Ouray Reservation. Salt Lake City, Utah: Univ. of Utah Bureau of Economic and Business Research, 1965.

Pratt, A. Glen. Rock Art of the Uintah Basin. Roosevelt, Ut.: Uintah Standard, 1972.

Books and Pamphlets

Raymer, Robert G. *Early Mining In Utah.* n. p., n. d.

Rockwell, Wilson. *The Utes, A Forgotten People.* Denver, Colo.: Sage Books, 1956.

Roylance, Ward J. *Utah's Geography and Counties.* Salt Lake City: 1972, 1962.

Sotalka, Edward F. (ed.). *International Association to the Geology and Mineral Resources of the Uinta Basin, Utah's Hydrocarbon Storehouse.* Salt Lake City: 1964.

Stone, Elizabeth Arnold. *Uinta County: Its Place in History.* Laramie, Wyo.: Laramie Print Co., 1924.

Sutton, Wain, ed. *Utah: A Centennial History*. New York: Lewis Historical Publishing Co., Inc., 1949.

Tullidge, Edward Wheelock. *Tullidge's Histories Containing the History of Northern, Eastern and Western Counties of Utah; also the Counties of Southern Idaho.* Salt Lake City: Utah Press of the Juvenile Instructor, 1889.

"Uinta Railway." *Utah: A Centennial History*. Vol. II.

"Uintah Railway." *Denver Westerners Roundup.* Denver, 1959.

Union Pacific Railroad Company. *Resources of the State of Utah.* 14th ed. Omaha, Neb.: Union Pacific Railroad Co., 1911.

Unterman, G. Ernest. *Guide to Dinosaur Land and the Unique Uinta Country.* Vernal, Utah: 1972.

Writer's Program. *Utah Gazetier (sic) of Utah Localities and Altitudes.* Salt Lake City: Division of Biology, Univ. of Utah, 1952.

Writer's Program. Utah. *Utah's Story American Guide Series.* Salt Lake City: 1942, Vol. V.

Writer's Program. Utah. *A Guide to the State.* N.Y.: Hastings House, (1954), 1941.

Wyman, Walker D. *The Legend of Charlie Glass, Negro Cowboy on the Colorado-Utah Range.* River Falls, Wisc.: River Falls State Univ. Press, 1970.

Utah State Documents

Utah State Road Committee. "General Highway Map, Uintah County, Utah." Salt Lake City: 1947.

Utah Dept. of Employment Security. Duchesne-Uintah Daggett Counties. "Industrial Patterns as of September 30, 1947."

Unpublished Works

Allen, Richard Cardell. "Governor George H. Dern and Utah's Participation in the Colorado River Compact, 1922-1933," Thesis, U of U, 1958.

Anderson, David W. "Sedimentology of the Duchesne River Formation (Eocene-Ogligacenen?) Northern Uintah Basin, Northeastern Utah." Ph.D. Dissertation, Salt Lake City, 1973.

Barber, James V. "The History of Highways in Utah from 1847-1869." Thesis, U of U, 1949.

Barnhardt, Michael T. "Tate Quaternary Geomorphology of the Bald Mountain Area, Uinta Mountains, Utah." Thesis, U of U, 1973.

Batty, Donald M. "History of Early Roads and Freighting in the Eastern Uintah Basin, 1672-1920." Thesis, USU, Logan, Ut., 1970.

Bennion, Milton L. "Highway Development in Utah." Thesis, U of U, 1932.

Borgquist, Erasmus S. "Report of E. S. Borgquist, Water Commissioner of the Uintah Basin for the Year 1915." Thesis, U of U, 1915.

Bracken, Lynn E. "The Economy of the Ute Indians." Thesis, U of U, 1928.

Bringhurst, Newell George. "The Mining Career of George H. Dern." Thesis, U of U, 1967.

Burton, Lloyd A. "A Geographical Study of the Alkaline Soils of the Duchesne-Roosevelt Area." Thesis, U of U, 1970.

Byrd, William D. "Geology of the Bitriminous Sandstone Deposits, Southeastern Uinta Basin, Uintah and Grand Counties Utah." Thesis, U of U, 1967.

Calef, Wesley Carr. "Land Associations and Occupance Problems in the Uinta County." Ph.D. Dissertation, U of U, 1948.

Cogier, Stanford O. "The Life of William Henry Hooper; Merchant Statesman." Thesis, U of U, 1956.

Crook, John G. "The Development of Early Industry and Trade in Utah." Thesis, U of U, 1926.

Davis, H. Clyde. "Geology of the Culver Gilsonite Vein of Duchesne County, Utah." Thesis, BYU, 1952.

Davis, Leland J. "The Characteristics, Occurrences and Uses of the Solid Bitumens of the Uinta Basin Utah." Thesis, BYU, 1951.

Grogger, Paul Karl. "Glaciation of the High Uintas Primitive Area, Utah. With Emphasis on the Northern Slope." Ph.D. Dissertation, U of U, 1974.

Gross, Larry T. Stratigraphic Analysis of the Mesaverde Group, Uinta Basin, Utah." Thesis, U of U, 1961.

Hammond, Jay M. "A Survey of the History of the Road Construction Industry in Utah." Thesis, BYU, 1967.

Justesen, Osmon. "Early Day Iron Mining in Utah Based Upon Source Material Dealing with Utah Industrial History." Thesis, U of U, 1918.

Kinsman, Leo Lynn. "A Geographic Analysis of Factors Contributing to Changing Population Patterns in Uintah County, Utah, 1950-65." Thesis, BYU, 1969.

Maxwell, Theodore A. "Paleohydrology and Depositional Environment of the Duchesne River Formation near Roosevelt, Utah." Thesis, U of U, 1933.

Murany, Ernest E. "Subsurface Stratigraphy of the Wasatch Formation of the Uinta Basin, Utah." Ph.D. Dissertation, U of U, 1963.

Nelson, James V. "The Environment of the Vegetation of the Upper Sonoran and Transition Zones in the Uintah Basin." Thesis, U of U, 1973.

Oakes, Dennis E. "The Role of Vernal in the Prosperity of Uintah County." Thesis, U of U, 1973.

O'Neil, Floyd. "A History of the Ute Indians of Utah Until 1890." Ph.D. Dissertation, U of U, 1973.

Reeder, Clarence A. "The History of Utah Railroads, 1869-1883." Ph.D. Dissertation, U of U, 1970.

Remington, Newell C. "A History of the Gilsonite Industry." Thesis, U of Ut, 1959.

Richie, Eleanor Louise. "Spanish Relations with Yuta Indians, 1680-1822." Thesis, U of Denver, 1932.

Teller, George H. "Sedimentary Features of the 'White Quartzite' in the Western Uinta Mountains, Utah." Thesis, U of U, 1956.

Thompson, William D. "Stratigraphy of Black Shale Focies of Green River Formation Eocene, Uinta Basin, Utah." Thesis, U of U, 1971.

Thorum, Reho F. "Railroad Development in Utah, 1869-79." Thesis, U of Wisc., 1936.

Van Deventer, Bruce R. "Petrology of the Moenkipi Formation (Early Triassic) Uinta Mountain Area, Northeastern Utah." Thesis, U of U, 1974.

Vaughn, Rodney L. "Sedimentology of the Dakota Formation (Cretaceous), Uinta Mountains, Northeastern Utah." Thesis, U of U, 1973.

Wahlquist, Wayne L. "An Economic Geograph y of Oil and Natural Gas in the Uintah Basin, Utah." Thesis, BYU, 1961.

Williamson, Charles R. "Carbonate Petrology of the Green River Formation (Eocene), Uintah Basin, Utah and Colorado." Thesis, 1972, U of U.

RECEIVED

JAN 28 1976
OFFICE OF
AREA OIL SHALE SUPERVISOR
U.S.G.S.

Uintah County Recorder
Book 24 p 335

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Entry No.087
Vernal 08432

PATENT.

THE UNITED STATES OF AMERICA,

TO ALL TO WHOM THESE PRESENTS SHALL COME GREETING:

WHEREAS, a Certificate of the Register of the Land Office at Vernal, Utah, has been deposited in the General Land Office, whereby it appears that, pursuant to the Act of Congress of May 20, 1862, "To Secure Homesteads to Actual Settlers on the Public Domain", and the acts supplemental thereto, the claim of George E. Pope has been established, and duly consummated in conformity to law, for the

Northwest quarter of the Northwest quarter of Section Fourteen and the North-half of the Northeast quarter and the Northeast quarter of the Northwest quarter of Section Fifteen in Township Ten South of Range Twenty-four East of the Salt Lake Meridian, Utah, containing one hundred sixty acres,

according to the Official Plat of the Survey of the said Land, returned to the General Land Office by the Surveyor-General:

NOW KNOW YE, That there is, therefore, granted by the United States unto the said claimant the tract of Land above described; TO HAVE AND TO HOLD the said tract of Land, with the appurtenances thereof, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted a right of way thereon for ditches or canals constructed by the authority of the United States. Also excepting and reserving to the United States all the oil and gas and all shale or other rock valuable as a source of petroleum and nitrogen in the lands so patented, and to it, or persons authorized by it, the right to prospect for, mine, and remove such deposits from the same upon compliance with the conditions and subject to the provisions and limitations of the Act of July 17,1914 (38 Stat.509).

IN TESTIMONY WHEREOF, I, Calvin Coolidge, President of the United States of America, have caused these letters to be made Patent and the seal of the General Land Office to be hereunto affixed.

GIVEN under my hand, at the City of Washington, the Twenty-seventh day of November in the year of our Lord one thousand nine hundred and Twenty-three and of the Independence of the United States the one hundred and Forty-eighth.

By the President: Calvin Coolidge
By Viola B. Pugh, Secretary.
(SEAL)
H. P. LeRoy, Recorder of the General Land Office.

RECORDED: Patent Number 924714

Filed for record January 19th 1924 at 1:30 P.M. Minnie [illegible] Recorder.

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45
Uintah County Records;
Book 24. p.168

Entry No.536245

Vernal 08127

PATENT

THE UNITED STATES OF AMERICA,

TO ALL TO WHOM THESE PRESENTS SHALL COME GREETING:

Whereas, a Certificate of the Register of the Land Office at Vernal, Utah, has been deposited in the General Land Office, whereby it appears that, pursuant to the Act of Congress of May 20, 1862, "To Secure Homesteads to Actual Settlers on the Public Domain," and the acts supplemental thereto, the claim of Eugene Pope has been extablished and duly consummated, in conformity to law, for the

East-half of the South-east quarter of Section Nine and the West-half of the South-west quarter of Section Ten in Township Ten South of Range Twenty-four East of the Salt Lake Meridian, Utah, containing one hundred sixty acres,

according to the Official Plat of the Survey of the said Land, returned to the General Land Office by the Surveyor-General:

NOW KNOW YE, That there is, therefore, granted by the United States unto the said claimant the tract of Land above described; TO HAVE AND TO HOLD the said tract of Land, with the appurtenances thereof, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted, a right of way thereon for ditches or canals constructed by the authobity of the United States.

Excepting and reserving also, to the United States all oil and gas and all shale or other rock valuable as a source of petroleum and nitrogen in the lands so patented, and to it, or persons authoeized by it, the right to prospect for, mine, and remove such deposits from the same upon compliance with the conditions and subject to the provisions and limitations of the Act of July 17, 1914 (38 Stat. 509).

IN TESTIMONY WHEREOF, I, Warren G. Harding, President of the United States of America, have caused these letters to be made Patent, and the seal of the General Land Office to be hereunto affixed.

GIVEN under my hand, at the City of Washington, the Eighteenth day of May in the year of our Lord one thousand nine hundred and Twenty-three and of the Independence of the United States the one hundred and Forty-seventh.

By the President: Warren G. Harding

(SEAL)

By Viola B. Pugh, Secretary

H. P. LeRoy Recorder of the General Land Office.

Recorded: Patent Number 906726

Filed for record July 5th 1923 at 9 A.M. ______ Recorder.

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46
Uintah County Recorder
Book 23. p. 234

Entry No. 53296.

Vernal 07935.

PATENT.
4-1003.

THE UNITED STATES OF AMERICA,

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETING:

WHEREAS, a Certificate of the Register of the Land Office at Vernal, Utah has been deposited in the General Land Office, whereby it appears that, pursuant to the Acts of Congress of May 20, 1862, "To Secure Homesteads to Actual Settlers on the Public Domain", and the acts supplemental thereto, the claim of Edwin J. Longhurst has been established and duly consummated, in conformity to law, for the northeast quarter of the southeast quarter of Section seventeen in Township ten south of Range twenty-four east of the Salt Lake Meridian, Utah, containing forty acres, according to the Official Plat of the Survey of the said land, returned to the GENERAL LAND OFFICE by the Surveyor General;

NOW KNOW YE, That there is, therefore granted by the UNITED STATES unto the said claimant the tract of Lnad above described;

TO HAVE AND TO HOLD the said tract of Lnad, with the appurtenances thereof, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accured water rights for mining, agricultral, manufactoring, or other purposes and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted a right-of way thereon for ditches or canals constructed by the authority of the United States. Excepting and reserving also, to the United States all oil and gas and all shale or other rock valuable as a source of petroleum and nitrogen in the lands sp patented and to it, or persons authorized by it, the right to prospect for mine, and remove such deposits from the same upon compliance with the conditions and subject to the provisions and limitations of the Act of July 17, 1914, (38 Stat., 509).

IN TESTIMONY WHEREOF, I, Warren G. Harding, President of the United States of America ha~~x~~ve caused these letters to be made Patent, and the seal of the General Land Office to be hereunto affixed.

GIVEN under my hand, in the District of Columbia, the fifth day of November in the year of our Lord one thousand nine hundred and twenty-one and of the Independence of the United States the one hundred and Forty-Sixth.

By the President: Warren G. Harding

By Viola B. Pugh Secretary.

(SEAL)

M.P. LeRoy
Recorder of the General Land Office.

RECORDED: Patent Number 831106.

Filed for record Nov. 17 A.D. 1921 at 1:56 P.M.

Minnie C. Fraser RECORDER

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Uintah County Recorder
Book 23 p. 491

Entry No. 533872.
Vernal07937.

The United States of America,

To all to whom these presents shall come, Greeting:

WHEREAS, aCertificate of the Register of the Land Office at Vernal, Utah, has been deposited in the General Land Office, whereby it appears that, pursuant to the Act of Congress of May 20, 1862, "To Secure Homesteads to Actual Settlers on the Public Domain," and the acts supplemental thereto, the claim of Gerald Hunting has been established and duly consumated, in conformity to law, for the east half of the northwest quarter and the south half of the northeast quarter of Section seventeen in Township ten south of range twenty-four east of the Salt Lake Meredian, Utah, containing one hundred sixty acres, according to the Official Plat of the Survey of the said Land, returned to the General Land Office by the Surveyor-General:

NOW KNOW YE, That there is, therefore, granted by the United States unto the said claimant the tract of Land above described;

TO HAVE AND TO HOLD the said tract of Land, with the appurtenances thereof, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manfacturing, or other purposes. and the rights to ditches and reservoirs used in connection with such water rights, as may be reconized and acknowledged by the local customs, laws, and decisions of courts; and there is reservor from the lands here by granted a right of way thereon for ditches or canals constructed by the authority of the United States. Excepting and reserving, also to the United States all oil and gas and all shale or other rock valuable as a source of potroleum and nitrogen in the lands so patented, and to it, or persons authorized by it, the right to prospect for, mine, and remove such deposits from the same upon compliance with the conditions and subject to the provisions and limitations of the act of July 17, 1914, (38 Stat.,509).

IN TESTIMONY WHEREOF, I, Warren G. Harding, President of the United States of America, have caused these letters to made Patent, and the seal of the General Land Office to be hereunto affixed.

Given under my hand, in the District of Columbia, theFIFTH day of NOVEMBER in the year of our Lord one thousand nine hundred and TWENTY-ONE and of the Independence of the United States the one hundred and FORTY-SIXTH.

By the President: Warren G. Harding.

By Viola B. Pugh, Secretary.

(SEAL)

M. P. LeRoy
Recorder of the General Land Office.

RECORDED: Patent Number 841107

Filed for record October 18th 1922 at 2P. M.

Minnie C. Preece Recorder.

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APPENDIX IV

National and State Legislation Relevant to the Protection and Preservation of Cultural Resources

Note: The quality of reproduction of the legal documents in Appendix IV is not as high as we would wish. However, the Utah State Historical Society does not possess original copies of these papers. Our only source for reproductive purposes is the Law Library, University of Utah campus, whose policy does not allow the removal of this material from the building. Thus, we have been forced to use the xerox machine at the library.

[Public—No. 209.]

An Act For the preservation of American antiquities

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

SEC. 2. That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and may reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected: Provided, That when such objects are situated upon a tract covered by a bona fide unperfected claim or held in private ownership, the tract, or so much thereof as may be necessary for the proper care and management of the object, may be relinquished to the Government, and the Secretary of the Interior is hereby authorized to accept the relinquishment of such tracts in behalf of the Government of the United States.

SEC. 3. That permits for the examination of ruins, the excavation of archeological sites, and the gathering of objects of antiquity upon the lands under their respective jurisdictions may be granted by the Secretaries of the Interior, Agriculture, and War to institutions which they may deem properly qualified to conduct such examination, excavation, or gathering, subject to such rules and regulations as they may prescribe: Provided, That the examinations, excavations, and gatherings are undertaken for the benefit of reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such objects, and that the gatherings shall be made for permanent preservation in public museums.

SEC. 4. That the Secretaries of the Departments aforesaid shall make and publish from time to time uniform rules and regulations for the purposes of carrying out the provisions of this Act.

Approved, June 8, 1906 (34 Stat. L. 225).

GPO 878-333

Cooperative protection, etc., agreements.

Proviso.
Federal obligation restriction.

(e) Contract and make cooperative agreements with States, municipal subdivisions, corporations, associations, or individuals, with proper bond where deemed advisable, to protect, preserve, maintain, or operate any historic or archaeologic building, site, object, or property used in connection therewith for public use, regardless as to whether the title thereto is in the United States: *Provided*, That no contract or cooperative agreement shall be made or entered into which will obligate the general fund of the Treasury unless or until Congress has appropriated money for such purpose.

Preserving antiquities and establishing museums.

(f) Restore, reconstruct, rehabilitate, preserve, and maintain historic or prehistoric sites, buildings, objects, and properties of national historical or archaeological significance and where deemed desirable establish and maintain museums in connection therewith.

Tablets marking historic places.

(g) Erect and maintain tablets to mark or commemorate historic or prehistoric places and events of national historical or archaeological significance.

Operating buildings, etc.

Proviso.
Concessions, etc.

(h) Operate and manage historic and archaeologic sites, buildings, and properties acquired under the provisions of this Act together with lands and subordinate buildings for the benefit of the public, such authority to include the power to charge reasonable visitation fees and grant concessions, leases, or permits for the use of land, building space, roads, or trails when necessary or desirable either to accommodate the public or to facilitate administration: *Provided*, That such concessions, leases, or permits, shall be let at competitive bidding, to the person making the highest and best bid.

Corporations to assist, may be organized.

(i) When the Secretary determines that it would be administratively burdensome to restore, reconstruct, operate, or maintain any particular historic or archaeologic site, building, or property donated to the United States through the National Park Service, he may cause the same to be done by organizing a corporation for that purpose under the laws of the District of Columbia or any State.

Educational program and service.

(j) Develop an educational program and service for the purpose of making available to the public facts and information pertaining to American historic and archaeologic sites, buildings, and properties of national significance. Reasonable charges may be made for the dissemination of any such facts or information.

Rules to be prescribed.

Penalty for violation.

(k) Perform any and all acts, and make such rules and regulations not inconsistent with this Act as may be necessary and proper to carry out the provisions thereof. Any person violating any of the rules and regulations authorized by this Act shall be punished by a fine of not more than $500 and be adjudged to pay all cost of the proceedings.

General advisory board established.

Composition.

Expenses.

SEC. 3. A general advisory board to be known as the "Advisory Board on National Parks, Historic Sites, Buildings, and Monuments" is hereby established, to be composed of not to exceed eleven persons, citizens of the United States, to include representatives competent in the fields of history, archaeology, architecture, and human geography, who shall be appointed by the Secretary and serve at his pleasure. The members of such board shall receive no salary but may be paid expenses incidental to travel when engaged in discharging their duties as such members.

Duties.

It shall be the duty of such board to advise on any matters relating to national parks and to the administration of this Act submitted to it for consideration by the Secretary. It may also recommend policies to the Secretary from time to time pertaining to national parks and to the restoration, reconstruction, conservation, and general administration of historic and archaeologic sites, buildings, and properties.

Cooperation of Government agencies.

Sec. 4. The Secretary, in administering this Act, is authorized to cooperate with and may seek and accept the assistance of any Federal, State, or municipal department or agency, or any educational or scientific institution, or any patriotic association, or any individual.

Technical advisory committees.

(b) When deemed necessary, technical advisory committees may be established to act in an advisory capacity in connection with the restoration or reconstruction of any historic or prehistoric building or structure.

Professional, etc., services.

(c) Such professional and technical assistance may be employed without regard to the civil-service laws, and such service may be established as may be required to accomplish the purposes of this Act and for which money may be appropriated by Congress or made available by gifts for such purpose.

Jurisdiction.

Sec. 5. Nothing in this Act shall be held to deprive any State, or political subdivision thereof, of its civil and criminal jurisdiction in and over lands acquired by the United States under this Act.

Appropriation authorized.
Post, p. 1795.

Sec. 6. There is authorized to be appropriated for carrying out the purposes of this Act such sums as the Congress may from time to time determine.

Conflicting laws repealed.

Sec. 7. The provisions of this Act shall control if any of them are in conflict with any other Act or Acts relating to the same subject matter.

Approved, August 21, 1935.

Public Law 86-523

June 27, 1960
[S. 1185]

AN ACT

To provide for the preservation of historical and archeological data (including relics and specimens) which might otherwise be lost as the result of the construction of a dam.

Historical and archeological data, preservation.

49 Stat. 666.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is the purpose of this Act to further the policy set forth in the Act entitled "An Act to provide for the preservation of historic American sites, buildings, objects, and antiquities of national significance, and for other purposes", approved August 21, 1935 (16 U.S.C. 461–467), by specifically providing for the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam by any agency of the United States, or by any private person or corporation holding a license issued by any such agency.

Dam construction.
Advance notice.

SEC. 2. (a) Before any agency of the United States shall undertake the construction of a dam, or issue a license to any private individual or corporation for the construction of a dam, it shall give written notice to the Secretary of the Interior setting forth the site of the proposed dam and the approximate area to be flooded and otherwise changed if such construction is undertaken: *Provided*, That with respect to any floodwater retarding dam which provides less than five thousand acre-feet of detention capacity and with respect to any other type of dam which creates a reservoir of less than forty surface acres the provisions of this section shall apply only when the constructing agency, in its preliminary surveys, finds, or is presented with evidence that historical or archeological materials exist or may be present in the proposed reservoir area.

Survey.

(b) Upon receipt of any notice, as provided in subsection (a), the Secretary of the Interior (hereinafter referred to as the "Secretary"), shall cause a survey to be made of the area proposed to be flooded to ascertain whether such area contains historical and archeological data (including relics and specimens) which should be preserved in the public interest. Any such survey shall be conducted as expeditiously as possible. If, as a result of any such survey, the Secretary shall determine (1) that such data exists in such area, (2) that such data has exceptional historical or archeological significance, and should be collected and preserved in the public interest, and (3) that it is feasible to collect and preserve such data, he shall cause the necessary work to be performed in such area to collect and preserve such data. All such work shall be performed as expeditiously as possible.

(c) The Secretary shall keep the instigating agency notified at all times of the progress of any survey made under this Act, or of any work undertaken as a result of such survey, in order that there will be as little disruption or delay as possible in the carrying out of the functions of such agency.

(d) A survey similar to that provided for by section (b) of this section and the work required to be performed as a result thereof shall so far as practicable also be undertaken in connection with any dam the construction of which has been heretofore authorized by any agency of the United States, or by any private person or corporation holding a license issued by any such agency.

(e) The Secretary shall consult with

institutions and qualified individuals, with a view to determining the ownership of and the most appropriate repository for any relics and specimens recovered as a result of any work performed as provided for in this section.

SEC. 3. In the administration of this Act, the Secretary may—

(1) enter into contracts or make cooperative agreements with any Federal or State agency, any educational or scientific organization, or any institution, corporation, association, or qualified individual; and

(2) procure the temporary or intermittent services of experts or consultants or organizations thereof as provided in section 15 of the Act of August 2, 1946 (5 U.S.C. 55a); and

(3) accept and utilize funds made available for salvage archeological purposes by any private person or corporations holding a license issued by an agency of the United States for the construction of a dam or other type of water or power control project.

SEC. 4. There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act.

Approved June 27, 1960.

Public Law 89-665

October 15, 1966
[S. 3035]

AN ACT

To establish a program for the preservation of additional historic properties throughout the Nation, and for other purposes.

Historic properties.
Preservation program established.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

The Congress finds and declares—

(a) that the spirit and direction of the Nation are founded upon and reflected in its historic past;

(b) that the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people;

(c) that, in the face of ever-increasing extensions of urban centers, highways, and residential, commercial, and industrial developments, the present governmental and nongovernmental historic preservation programs and activities are inadequate to insure future generations a genuine opportunity to appreciate and enjoy the rich heritage of our Nation; and

(d) that, although the major burdens of historic preservation have been borne and major efforts initiated by private agencies and individuals, and both should continue to play a vital role, it is nevertheless necessary and appropriate for the Federal Government to accelerate its historic preservation programs and activities, to give maximum encouragement to agencies and individuals undertaking preservation by private means, and to assist State and local governments and the National Trust for Historic Preservation in the United States to expand and accelerate their historic preservation programs and activities.

TITLE I

Buildings and objects, etc.
Expansion and maintenance of National Register.

SEC. 101. (a) The Secretary of the Interior is authorized—

(1) to expand and maintain a national register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture, hereinafter referred to as the National Register, and to grant funds to States for the purpose of preparing comprehensive statewide historic surveys and plans, in accordance with criteria established by the Secretary, for the preservation, acquisition, and development of such properties;

Grants to states.

(2) to establish a program of matching grants-in-aid to States for projects having as their purpose the preservation for public benefit of properties that are significant in American history, architecture, archeology, and culture; and

National Trust for Historic Preservation.

16 USC 468-468d.

(3) to establish a program of matching grant-in-aid to the National Trust for Historic Preservation in the United States, chartered by act of Congress approved October 26, 1949 (63 Stat. 927), as amended, for the purpose of carrying out the responsibilities of the National Trust.

(b) As used in this Act—

"State."

(1) The term "State" includes, in addition to the several States of the Union, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa.

"Project."

(2) The term "project" means programs of State and local governments and other public bodies and private organizations and individuals for the acquisition of title or interests in, and for the develop-

ment of, any district, site, building, structure, or object that is significant in American history, architecture, archeology, and culture, or property used in connection therewith, and for its development in order to assure the preservation for public benefit of any such historical properties.

"Historic preservation."

(3) The term "historic preservation" includes the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, or culture.

"Secretary."

(4) The term "Secretary" means the Secretary of the Interior.

Conditions for grants.

Sec. 102. (a) No grant may be made under this Act—

(1) unless application therefor is submitted to the Secretary in accordance with regulations and procedures prescribed by him;

(2) unless the application is in accordance with the comprehensive statewide historic preservation plan which has been approved by the Secretary after considering its relationship to the comprehensive statewide outdoor recreation plan prepared pursuant to the Land and Water Conservation Fund Act of 1965 (78 Stat. 897);

16 USC 460l-4 note.

(3) for more than 50 per centum of the total cost involved, as determined by the Secretary and his determination shall be final;

(4) unless the grantee has agreed to make such reports, in such form and containing such information as the Secretary may from time to time require;

(5) unless the grantee has agreed to assume, after completion of the project, the total cost of the continued maintenance, repair, and administration of the property in a manner satisfactory to the Secretary; and

(6) until the grantee has complied with such further terms and conditions as the Secretary may deem necessary or advisable.

Waiver.

(b) The Secretary may in his discretion waive the requirements of subsection (a), paragraphs (2) and (5) of this section for any grant under this Act to the National Trust for Historic Preservation in the United States, in which case a grant to the National Trust may include funds for the maintenance, repair, and administration of the property in a manner satisfactory to the Secretary.

(c) No State shall be permitted to utilize the value of real property obtained before the date of approval of this Act in meeting the remaining cost of a project for which a grant is made under this Act.

Apportionment.

Sec. 103. (a) The amounts appropriated and made available for grants to the States for comprehensive statewide historic surveys and plans under this Act shall be apportioned among the States by the Secretary on the basis of needs as determined by him: *Provided, however*, That the amount granted to any one State shall not exceed 50 per centum of the total cost of the comprehensive statewide historic survey and plan for that State, as determined by the Secretary.

Limitation.

(b) The amounts appropriated and made available for grants to the States for projects under this Act for each fiscal year shall be apportioned among the States by the Secretary in accordance with needs as disclosed in approved statewide historic preservation plans.

The Secretary shall notify each State of its apportionment, and the amounts thereof shall be available thereafter for payment to such State for projects in accordance with the provisions of this Act. Any amount of any apportionment that has not been paid or obligated by the Secretary during the fiscal year in which such notification is given, and for two fiscal years thereafter, shall be reapportioned by the Secretary in accordance with this subsection.

Coordination with other Federal programs.

SEC. 104. (a) No grant may be made by the Secretary for or on account of any survey or project under this Act with respect to which financial assistance has been given or promised under any other Federal program or activity, and no financial assistance may be given under any other Federal program or activity for or on account of any survey or project with respect to which assistance has been given or promised under this Act.

(b) In order to assure consistency in policies and actions under this Act with other related Federal programs and activities, and to assure coordination of the planning acquisition, and development assistance to States under this Act with other related Federal programs and activities, the President may issue such regulations with respect thereto as he deems desirable, and such assistance may be provided only in accordance with such regulations.

Records.

SEC. 105. The beneficiary of assistance under this Act shall keep such records as the Secretary shall prescribe, including records which fully disclose the disposition by the beneficiary of the proceeds of such assistance, the total cost of the project or undertaking in connection with which such assistance is given or used, and the amount and nature of that portion of the cost of the project or undertaking supplied by other sources, and such other records as will facilitate an effective audit.

SEC. 106. The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under title II of this Act a reasonable opportunity to comment with regard to such undertaking.

Exemptions.

SEC. 107. Nothing in this Act shall be construed to be applicable to the White House and its grounds, the Supreme Court building and its grounds, or the United States Capitol and its related buildings and grounds.

Appropriation.

SEC. 108. There are authorized to be appropriated not to exceed $2,000,000 to carry out the provisions of this Act for the fiscal year 1967, and not more than $10,000,000 for each of the three succeeding fiscal years. Such appropriations shall be available for the financial assistance authorized by this title and for the administrative expenses of the Secretary in connection therewith, and shall remain available until expended.

TITLE II

Advisory Council on Historic Preservation, membership.

SEC. 201. (a) There is established an Advisory Council on Historic Preservation (hereinafter referred to as the "Council") which shall be composed of seventeen members as follows:

(1) The Secretary of the Interior.
(2) The Secretary of Housing and Urban Development.
(3) The Secretary of Commerce.
(4) The Administrator of the General Services Administration.
(5) The Secretary of the Treasury.
(6) The Attorney General.
(7) The Chairman of the National Trust for Historic Preservation.

(8) Ten appointed by the President from outside the Federal Government. In making these appointments, the President shall give due consideration to the selection of officers of State and local governments and individuals who are significantly interested and experienced in the matters to be considered by the Council.

(b) Each member of the Council specified in paragraphs (1) through (6) of subsection (a) may designate another officer of his department or agency to serve on the Council in his stead.

Terms of office.

(c) Each member of the Council appointed under paragraph (8) of subsection (a) shall serve for a term of five years from the expiration of his predecessor's term; except that the members first appointed under that paragraph shall serve for terms of from one to five years, as designated by the President at the time of appointment, in such manner as to insure that the terms of not less than one nor more than two of them will expire in any one year.

(d) A vacancy in the Council shall not affect its powers, but shall be filled in the same manner as the original appointment (and for the balance of the unexpired term).

Chairman, selection.

(e) The Chairman of the Council shall be designated by the President.

(f) Eight members of the Council shall constitute a quorum.

Duties.

SEC. 202. (a) The Council shall—

(1) advise the President and the Congress on matters relating to historic preservation; recommend measures to coordinate activities of Federal, State, and local agencies and private institutions and individuals relating to historic preservation; and advise on the dissemination of information pertaining to such activities;

(2) encourage, in cooperation with the National Trust for Historic Preservation and appropriate private agencies, public interest and participation in historic preservation;

(3) recommend the conduct of studies in such areas as the adequacy of legislative and administrative statutes and regulations pertaining to historic preservation activities of State and local governments and the effects of tax policies at all levels of government on historic preservation;

(4) advise as to guidelines for the assistance of State and local governments in drafting legislation relating to historic preservation; and

(5) encourage, in cooperation with appropriate public and private agencies and institutions, training and education in the field of historic preservation.

Report to President and Congress.

(b) The Council shall submit annually a comprehensive report of its activities and the results of its studies to the President and the Congress and shall from time to time submit such additional and special reports as it deems advisable. Each report shall propose such legislative enactments and other actions as, in the judgment of the Council, are necessary and appropriate to carry out its recommendations.

Other Federal agencies, cooperation.

SEC. 203. The Council is authorized to secure directly from any department, bureau, agency, board, commission, office, independent establishment or instrumentality of the executive branch of the Federal Government information, suggestions, estimates, and statistics for the purpose of this title; and each such department, bureau, agency, board, commission, office, independent establishment or instrumentality is authorized to furnish such information, suggestions, estimates, and statistics to the extent permitted by law and within available funds.

Compensation.

SEC. 204. The members of the Council specified in paragraphs (1) through (7) of section 201(a) shall serve without additional compensation. The members of the Council appointed under paragraph (8) of section 201(a) shall receive $100 per diem when engaged in the performance of the duties of the Council. All members of the Council shall receive reimbursement for necessary traveling and subsistence expenses incurred by them in the performance of the duties of the Council.

Executive Director.

SEC. 205. (a) The Director of the National Park Service or his designee shall be the Executive Director of the Council. Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel and procurement) shall be provided the Council by the Department of the Interior, for which payments shall be made in advance, or by reimbursement, from funds of the Council in such amounts as may be agreed upon by the Chairman of the Council and the Secretary of the Interior: *Provided*, That the regulations of the Department of the Interior for the collection of indebtedness of personnel resulting from erroneous payments (5 U.S.C. 46e) shall apply to the collection of erroneous payments made to or on behalf of a Council employee, and regulations of said Secretary for the administrative control of funds (31 U.S.C. 665 (g)) shall apply to appropriations of the Council: *And provided further*, That the Council shall not be required to prescribe such regulations.

68 Stat. 483.

Personnel.

(b) The Council shall have power to appoint and fix the compensation of such additional personnel as may be necessary to carry out its duties, without regard to the provisions of the civil service laws and the Classification Act of 1949.

Ante, p. 283.

(c) The Council may also procure, without regard to the civil service laws and the Classification Act of 1949, temporary and intermittent services to the same extent as is authorized for the executive departments by section 15 of the Administrative Expenses Act of 1946 (5 U.S.C. 55a), but at rates not to exceed $50 per diem for individuals.

60 Stat. 810.

(d) The members of the Council specified in paragraphs (1) through (6) of section 201(a) shall provide the Council, on a reimbursable basis, with such facilities and services under their jurisdiction and control as may be needed by the Council to carry out its duties, to the extent that such facilities and services are requested by the Council and are otherwise available for that purpose. To the extent of available appropriations, the Council may obtain, by purchase, rental, donation, or otherwise, such additional property, facilities, and services as may be needed to carry out its duties.

Approved October 15, 1966.

Public Law 91-190
91st Congress, S. 1075
January 1, 1970

An Act

83 STAT. 852

To establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969".

National Environmental Policy Act of 1969.

PURPOSE

SEC. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

TITLE I

DECLARATION OF NATIONAL ENVIRONMENTAL POLICY

Policies and goals.

SEC. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Administration.

SEC. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall—

(A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and [illegible] consideration in decisionmaking al[illegible] nical considerations;

(C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) the environmental impact of the proposed action,

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) alternatives to the proposed action,

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Copies of statements, etc.;availability.

81 Stat. 54.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;

(D) study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(E) recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(F) make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(G) initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(H) assist the Council on Environmental Quality established by title II of this Act.

Review.

SEC. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act.

SEC. 104. Nothing in Section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

SEC. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II

COUNCIL ON ENVIRONMENTAL QUALITY

Report to Congress.

SEC. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban, and rural environment; (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals, with particular reference to their effect on the environment and on the conservation, development and utilization of natural resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation.

Council on Environmental Quality.

SEC. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act; to be conscious of and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment.

SEC. 203. The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof). 80 Stat. 416.

Duties and functions. SEC. 204. It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

SEC. 205. In exercising its powers, functions, and duties under this Act, the Council shall—

(1) consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order numbered 11472, dated May 29, 1969, and with such representatives of science, 34 F. R. 8693. industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

(2) utilize, to the fullest extent possible, the services, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

Sec. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV of the Executive Schedule Pay Rates (5 U.S.C. 5315).

Tenure and compensation.
80 Stat. 460, 461.

81 Stat. 638.

Sec. 207. There are authorized to be appropriated to carry out the provisions of this Act not to exceed $300,000 for fiscal year 1970, $700,000 for fiscal year 1971, and $1,000,000 for each fiscal year thereafter.

Appropriations.

Approved January 1, 1970.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 91-378, 91-378, pt. 2, accompanying H. R. 12549 (Comm. on Merchant Marine & Fisheries) and 91-765 (Comm. of Conference).
SENATE REPORT No. 91-296 (Comm. on Interior & Insular Affairs).
CONGRESSIONAL RECORD, Vol. 115 (1969):
July 10: Considered and passed Senate.
Sept. 23: Considered and passed House, amended, in lieu of H. R. 12549.
Oct. 8: Senate disagreed to House amendments; agreed to conference.
Dec. 20: Senate agreed to conference report.
Dec. 22: House agreed to conference report.

Presidential Documents

Title 3—The President

EXECUTIVE ORDER 11593

Protection and Enhancement of the Cultural Environment

By virtue of the authority vested in me as President of the United States and in furtherance of the purposes and policies of the National Environmental Policy Act of 1969 (83 Stat. 852, 42 U.S.C. 4321 et seq.), the National Historic Preservation Act of 1966 (80 Stat. 915, 16 U.S.C. 470 et seq.), the Historic Sites Act of 1935 (49 Stat. 666, 16 U.S.C. 461 et seq.), and the Antiquities Act of 1906 (34 Stat. 225, 16 U.S.C. 431 et seq.), it is ordered as follows:

SECTION 1. *Policy.* The Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Agencies of the executive branch of the Government (hereinafter referred to as "Federal agencies") shall (1) administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, (2) initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored and maintained for the inspiration and benefit of the people, and (3), in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

SEC. 2. *Responsibilities of Federal agencies.* Consonant with the provisions of the acts cited in the first paragraph of this order, the heads of Federal agencies shall:

(a) no later than July 1, 1973, with the advice of the Secretary of the Interior, and in cooperation with the liaison officer for historic preservation for the State or territory involved, locate, inventory, and nominate to the Secretary of the Interior all sites, buildings, districts, and objects under their jurisdiction or control that appear to qualify for listing on the National Register of Historic Places.

(b) exercise caution during the interim period until inventories and evaluations required by subsection (a) are completed to assure that any federally owned property that might qualify for nomination is not inadvertently transferred, sold, demolished or substantially altered. The agency head shall refer any questionable actions to the Secretary of the Interior for an opinion respecting the property's eligibility for inclusion on the National Register of Historic Places. The Secretary shall consult with the liaison officer for historic preservation for the State or territory involved in arriving at his opinion. Where, after a reasonable period in which to review and evaluate the property, the Secretary determines that the property is likely to meet the criteria prescribed for listing on the National Register of Historic Places, the Federal agency head shall reconsider the proposal in light of national environmental and preservation policy. Where, after such reconsideration, the Federal agency head proposes to transfer, sell, demolish or substantially alter the property he shall not act with respect to the property until the Advisory Council on Historic Preservation shall have been provided an opportunity to comment on the proposal.

(c) initiate measures to assure that where as a result of Federal action or assistance a property listed on the National Register of Historic Places is to be substantially altered or demolished, timely steps be taken to make or have made records, including measured drawings, photographs and maps, of the property, and that copy of such records then be deposited in the Library of Congress as part of the Historic American Buildings Survey or Historic American Engineering Record for future use and reference. Agencies may call on the Department of the Interior for advice and technical assistance in the completion of the above records.

(d) initiate measures and procedures to provide for the maintenance, through preservation, rehabilitation, or restoration, of federally owned and registered sites at professional standards prescribed by the Secretary of the Interior.

(e) submit procedures required pursuant to subsection (d) to the Secretary of the Interior and to the Advisory Council on Historic Preservation no later than January 1, 1972, and annually thereafter, for review and comment.

(f) cooperate with purchasers and transferees of a property listed on the National Register of Historic Places in the development of viable plans to use such property in a manner compatible with preservation objectives and which does not result in an unreasonable economic burden to public or private interests.

SEC. 3. *Responsibilities of the Secretary of the Interior.* The Secretary of the Interior shall:

(a) encourage State and local historic preservation officials to evaluate and survey federally owned historic properties and, where appropriate, to nominate such properties for listing on the National Register of Historic Places.

(b) develop criteria and procedures to be applied by Federal agencies in the reviews and nominations required by section 2(a). Such criteria and procedures shall be developed in consultation with the affected agencies.

(c) expedite action upon nominations to the National Register of Historic Places concerning federally owned properties proposed for sale, transfer, demolition or substantial alteration.

(d) encourage State and Territorial liaison officers for historic preservation to furnish information upon request to Federal agencies regarding their properties which have been evaluated with respect to historic,

Encl. 2-2

architectural or archaeological significance and which as a result of such evaluations have not been found suitable for listing on the National Register of Historic Places.

(e) develop and make available to Federal agencies and State and local governments information concerning professional methods and techniques for preserving, improving, restoring and maintaining historic properties.

(f) advise Federal agencies in the evaluation, identification, preservation, improvement, restoration and maintenance of historic properties.

(g) review and evaluate the plans of transferees of surplus Federal properties transferred for historic monument purposes to assure that the historic character of such properties is preserved in rehabilitation, restoration, improvement, maintenance and repair of such properties.

(h) review and comment upon Federal agency procedures submitted pursuant to section 2(c) of this order.

Richard Nixon

THE WHITE HOUSE,
May 13, 1971.

[FR Doc.71-6951 Filed 5-14-71;12:18 pm]

NOTE: For the text of a Presidential statement issued in connection with E.O. 11593 above, see Weekly Comp. of Pres. Docs., Vol. 7, issue of May 17, 1971.

Indexed
Proof Read

(UTAH STATE ANTIQUITIES)

1973

GENERAL SESSION

Substitute
H.B. No. 34

By David R. Irvine
John P. Redd

AN ACT CREATING WITHIN THE DIVISION OF STATE HISTORY A STATE ANTIQUITIES SECTION TO ESTABLISH ARCHAEOLOGICAL SITES, FOR THE COLLECTION AND PRESERVATION OF SPECIMENS AND RECORDS AND FOR THE EDITING AND PUBLICATION OF ANTIQUITIES RECORDS; PROVIDING FOR THE CREATION AND COMPOSITION OF AN ANTIQUITIES COMMITTEE TO ADVISE THE STATE BOARD OF HISTORY IN POLICY MATTERS RELATED TO ANTIQUITIES; AND PROVIDING PENALTIES.

Be it enacted by the Legislature of the State of Utah:

Section 1. The legislature declares that the public has an interest in the preservation and protection of the state's archaeological and anthropological resources and a right to the knowledge derived and gained from scientific study of those resources. It is the purpose of this act to provide that activities for the preservation, excavation, study and exhibition of the state's archaeological and anthropological resources be undertaken in a coordinated and organized manner for the general welfare of the public.

Section 2. As used in this act:

(1) "Specimens" means all man-made relics, artifacts, and remains of a prehistorical, archaeological, or anthropological nature found on or below the surface of the earth.

(2) "Site" means any aboriginal mound, fort, building, earth work, village location, burial ground, prehistoric ruin, cave, petroglyphs, pictographs, or other location which is the source of specimens.

Section 3. There is created within the division of state history a state antiquities section. The state antiquities section is the authority of the state for the protection and orderly development of archaeological and anthropological resources.

Section 4. The state antiquities section is responsible for the stimulation of research, study, and activities in the field of antiquities; the marking, protection, and preservation of sites; the collection, preservation, and administration of specimens and records; and the editing and publication of antiquities records. The section shall cooperate with local, state, and federal agencies and all interested persons to achieve the purposes of this act.

Section 5. An antiquities committee consisting of the chairman and vice chairman of the board of state history, director of the division of state history, director of the division of parks and recreation, director of the museum of natural history, two professional archaeologists and three other persons from various geographical areas of the state with demonstrated interest in antiquities, one of whom shall be an Indian, is created to advise the state board of history in matters related to antiquities. The professional archaeologists and three interested persons shall be appointed by the governor.

The gubernatorial appointee members shall serve four years. Members shall serve without compensation but are entitled to reimbursement for their necessary and actual expenses. The antiquities committee may make rules for its own government with the concurrence of the state board of history and advise the board on matters of policy for the antiquities section.

Section 6. The governor shall extend an invitation to participate on the antiquities committee to the regional forester of the United States Department of Agriculture for the intermountain region, the state director of the bureau of land management, and the state director of national park service areas for Utah.

Section 7. The director of the division of state history, upon recommendation of the antiquities committee, shall select the state archaeologist who may create a staff to carry out the policies assigned him by the board of state history.

Section 8. It is unlawful for any person to enter a site located on state land or lands owned or controlled by the state or its subdivisions, or which have been designated as landmarks pursuant to this act, for the purpose of appropriating, injuring, or destroying a specimen without a permit from the division of state history. Application for a permit shall be made on a form furnished by the antiquities section and accompanied by the payment of a fee or posting of a bond to be determined by the state board of history. All archaeological work shall be carried out under the supervision of the state archaeologist and in accordance with rules adopted by the state antiquities section in such a manner that the maximum amount of historic, scientific, archaeological, anthropological, and educational information may be recovered and preserved in addition to the physical recovery of items. The state archaeologist may revoke or suspend a permit or declare the bond to be forfeited if the permitee fails to conduct the excavation in a manner consistent with rules promulgated by the state antiquities section. All items recovered by permitees shall be the property of the state; provided, that the state board of history with the advice of the antiquities committee may allot a fair share of the items recovered to the permitee. A permitee may be required to submit duplicates of any written or photographic data obtained in the course of field investigations to the division of state history.

Section 9. Sites of significance may be recommended to the governor's historic and cultural sites review committee by the antiquities committee with the approval of the state board of history as "state archaeological or anthropological landmarks," provided that no privately owned site shall be so designated without the written consent of the owner. It is unlawful to excavate upon a privately owned designated site without a permit from the division of state history. Before any alteration is commenced on a designated landmark, three months notice of his intent to alter the site shall be given the division of state history.

Section 10. Any person who discovers any site or specimen on lands owned by the state shall promptly report discovery to the division of state history and prior to further alteration cooperate with the division of state history in any salvage or preservation operations. It is the intention of the legislature that discovery on privately owned lands of sites or specimens should be immediately reported to the division of state history and that field investigations should be discouraged except in accordance with this act.

Section 11. The museum of natural history is the depository for copies of archaeological field notes, photographs, publications, or other records obtained by whatever agency or person, pursuant to any permit. All specimens which the antiquities section retains shall be deposited at the museum of natural history; provided, that items may be loaned to appropriate institutions upon request. Data collected by the antiquities section shall be made available to qualified individuals consistent with this act. The museum of natural history shall provide for display of selected items as appropriate.

Section 12. It is unlawful to appropriate, injure, or destroy any site or specimen situated on lands owned or controlled by the state or its subdivisions, or which have been designated as landmarks pursuant to this act. No specimen shall be removed from the state without permission of the division of state history. Any person seeking to remove specimens from the state shall forfeit to the state all articles and materials discovered, collected, excavated, or offered for sale or exchange, together with all photographs and records relating to such objects.

Section 13. It is unlawful to reproduce, rework, or forge any specimen or make any object, whether copied or not, or falsely label, describe, identify, or offer for sale or exchange any object, with intent to represent the same as an original and genuine specimen, nor shall any person offer for sale or other exchange any object with knowledge that it was collected or excavated in violation of this act.

Section 14. Any person who violates this act is guilty of a misdemeanor.

APPENDIX V

Vitae of Responsible Investigator, Coauthors, and Consultant

Vita: David B. Madsen

Birth Date: January 31, 1946

U.S. Citizen: yes
FID 529-54-9620

Formal Education:

School	Major	Dates	Degree and Date
University of Utah	Anthropology	1964-1969	B.A. - 1969
University of Utah	Anthropology	1969-1971	M.A. - 1971
University of Missouri	Anthropology	1971-1973	Ph.D.- 1973

Professional Employment History:

Institution	Title	Dates
Antiquities Section, Division of State History	State Archeologist	1973 - Present
University of Missouri	Research Associate	1971 - 1973
University of Utah	Teaching Assistant	1969 - 1971
Desert Research Institute	Field Supervisor	1969 - 1971 (Summers)

University of Utah - Rank/Title

Adjunct Assistant Professor of Anthropology	1974 - Present

Professional and Honorary Organizations:

American Anthropological Association
Society of American Archeology
Great Basin Anthropology Conference
Plains Anthropological Conference
Pecos Conference

Publications:

(see attached pages)

Grants and Contracts:

Paleoecological Research in Southeastern Nevada, National Science Foundation, $4600.00, 1972-73

Archeological Survey of Oil Shale Lands U-a and U-b, Uintah County, Utah, VTN Consolidated Corporation of Colorado, $49,680.00, 1974-75

Archeological Survey of Arches National Park, National Park Service, $16,800.00, 1974-75

Publications and Papers

Papers

1974 A Reassessment of Hogup Cave and the Implications for Northeastern Great Basin Prehistory. Delivered at the 1974 Great Basin Anthropological Conference. Carson City, Nevada. (with M. S. Berry).

1974 Holocene Fluctuations of Great Salt Lake. Delivered at the 1974 American Quaternary Association Meetings. Madison, Wisconsin. (with D.R. Currey).

1973 Pluvial - Post-Pluvial Vegetation Changes in the Southeastern Great Basin. Delivered at the XXXVIII Annual Meeting of the Society for American Archeology. San Francisco.

1972 Paleoecological Investigations in Meadow Valley Wash, Nevada. Delivered at the 1972 Great Basin Anthropological Conference. Salt Lake City.

1970 O'Malley Shelter Interim Report. Delivered at the 1970 Great Basin Anthropological Conference. Eugene, Oregon. (with D.D. Fowler).

1970 Excavations and Survey in Clover Valley Wash. Delivered at the 1970 Pecos Conference. Santa Fe.

1970 Fremont Ceramic Areal Distributions. Delivered at the XXXV Annual Meeting of the Society for American Archeology. Mexico City.

1969 Test Excavations in Clover Valley Wash. Delivered at the 1969 Pecos Conference. Prescott, Arizona.

1969 Ultraviolet Light: the Primary Basis for Variation of Skin Pigmentation. Delivered at the 1969 Southwestern Students Conference in Anthropology. Portales, New Mexico. (abstract published in The Student Anthropologist, University of Colorado Press, Boulder).

Publications

1975 A Reassessment of Northeastern Great Basin Prehistory. American Antiquity, Vol. 40, No. 4, (in press). Washington. (With Michael S. Berry.)

1975 Dating Paiute-Shoshoni Expansion in the Great Basin. American Antiquity, Vol. 40, No. 1, pp. 82-86. Washington.

1974 Holocene Stratigraphy and Archeology in the Middle Missouri River Trench, South Dakota. Science, vol. 184, pp. 905-908. (with S. Ahler, D. Davies, and C. Falk).

1973 Prehistory of Southeastern Nevada. Desert Research Institute Publications in the Social Sciences, No. 6. (with D.D. Fowler and E.M. Hattori).

1973 Late Quarternary Paleoecology in the Southeastern Great Basin. Ph.D. Dissertation, Department of Anthropology, University of Missouri. Columbia.

1973 Northern Fremont Ceramics. In G.F. Fry and G.F. Dalley, the Levee and Knoll Sites, University of Utah Anthropological Papers, No. 98. Salt Lake City.

1973 The Pollen Analysis of O'Malley and Conway Shelters. Appendix II, In, D.D. Fowler, D.B. Madsen, and E.M. Hattori, Prehistory of Southeastern Nevada. Desert Research Institute Publications in the Social Sciences, No. 6. Reno.

1972 Paleoecological Investigations in Meadow Valley Wash, Nevada. In, D.D. Fowler (Ed.), Great Basin Cultural Ecology: A Symposium. Desert Research Institute Publications in the Social Sciences, No. 8. Reno.

1971 O'Malley Shelter. M.A. Thesis, Department of Anthropology, University of Utah. Salt Lake City.

1970 Median Village Ceramics and the Distribution of Fremont Plain Gray Wares. In, J.P. Marwitt, Median Village and Fremont Culture Regional Variation. University of Utah Anthropological Papers, No. 94. Salt Lake City.

Papers Accepted for Publication

Great Basin Ceramics. Article for the Smithsonian Institution: Handbook of North American Indians, Vol. X: Great Basin.

Southeastern Great Basin Archeology (with D.D. Fowler). Article for the Smithsonian Institution: Handbook of North American Indians, vol. X: Great Basin.

Pluvial - Post-Pluvial Vegetation Changes in the Southeastern Great Basin. Article for the Nevada State Museum Anthropological Papers.

VITA

Name.	Michael S. Berry
Born.	July 31, 1942, Sacramento, California
F.I.D.	547-66-3484
Marital status	Married

Education.

B.A. Anthropology, 1970, Fort Lewis College; Durango, Colorado.

M.A. Anthropology, 1974, University of Utah; Salt Lake City, Utah.

Field Experience.

1969 - Student, archeological field school at Fort Lewis College; Durango, Colorado.

1971 - Student, archeological field school at University of Utah; Salt Lake City, Utah.
Supervisor of excavations at Surprize Village (42Sa2139); Blanding, Utah.

1972 - Teaching Assistant at the University of Utah archaeological field school.
Supervisor of excavations at Remnant Cave (42Bo365); Grouse Creek, Utah.
Supervisor of excavations at Beatty Springs (42Bo200); Grouse Creek, Utah.
Supervisor of Strawberry Reservoir Survey; Environmental impact study for the Central Utah Project.

1973 - Supervisor of Highway U-95 archaeological project; Blanding, Utah.
Supervisor of excavations at No-Name Springs (26Ek910); Montello, Nevada.
Supervisor of test excavations at Cowboy Cave (42Wn420); Hanksville, Utah.

1974 - Supervisor, Uintah Basin oil-shale archaeological survey; Bonanza, Utah.
Supervisor, archaeological survey of Arches National Monument; Moab, Utah.

In addition, I have done numerous short-term surveys in various parts of Utah.

Other Experience.

1970-73. Archaeological draftsman, Department of Anthropology, University of Utah

1971-73. Research assistant involved in artifact analysis and archeological report writing; University of Utah; Salt Lake City, Utah.

1973-74. Archeologist 15, Antiquities Section, Division of State History; Salt Lake City, Utah.

1974-75. Archeologist 19, Antiquities Section, Division of State History; Salt Lake City, Utah.

Papers and Publications.

1971a. "Excavations at the Evans Mound: An Interim Report." Ms. on file at the Department of Anthropology, University of Utah; Salt Lake City, Utah.

1971b. "The Evans Mound: A Progress Report." Paper delivered at the Great Basin Anthropological Conference, Salt Lake City, Utah.

1972a. "Surprize Village." In Highway U-95 Archaeology: Comb Wash to Grand Flat. Gardiner F. Dalley (ed.). Special Report of the Department of Anthropology, University of Utah; Salt Lake City Utah

1972b. "The Evans Site." Special Report of the Department of Anthropology, University of Utah; Salt Lake City, Utah.

1974a. "The Evans Mound: Cultural Adaptation in Southwestern Utah." M.A. Thesis, on file, Department of Anthropology, University of Utah; Salt Lake City, Utah.

1974b. "A Reassessment of Hogup Cave and the Implications for Northeastern Great Basin Prehistory" (with D. B. Madsen). Paper delivered at the Great Basin Anthropological Conference, Carson City, Nevada.

1975a. "A Reassessment of Northeastern Great Basin Prehistory" (with D. B. Madsen). In press, American Antiquity; Washington D. C.

1975b. Review of "The Classic Southwest: Readings in Archaeology, Ethnohistory and Ethnology," B. C. Hedrick, J. C. Kelley and C. L. Kelley (Eds.), 1973 Southern Illinois University Press. In press, Utah Historical Quarterly; Salt Lake City, Utah.

1975c.	"A Sketch of Utah Prehistory." In press. Utah Historical Preservation Plan. Published by the Utah Historical Society Press; Salt Lake City, Utah.
n.d.	"Remnant Cave." In G. F. Dalley, Archeology of Northwestern Utah and Northeastern Nevada. Ms. in press, University of Utah Press; Salt Lake City, Utah.
n.d.	"No-Name Valley." In G. F. Dalley, Archeology of Northwestern Utah and Northeastern Nevada. Ms. in press, University of Utah Press; Salt Lake City, Utah.

Research Interests.

Culture History of the Great Basin and Colorado Plateau

Cultural Ecology, Paleoecology

VITA

Name	Claudia J. Fromberg Berry
Born	December 20, 1942, Braddock, Pennsylvania
F.I.D.	535-40-8294
Marital Status	Married, no children

Education

B.A. History, 1970, Portland State University; Portland Oregon.

M.A. Anthropology, 1972, Waived, University of Utah; Salt Lake City, Utah.

Field Experience

1971 - Student participant in excavations of Coastal Shell middens near Seaside, Oregon; Portland State University.

Student, archaeological field school at Evans Mound (42In40), University of Utah; Salt Lake City, Utah.

Participant, excavations at Suprize Village (42Sa2139); Blanding, Utah.

1972 - Supervisor of excavations at Gnat Knoll (42Sa2140), Rattler's Midden (42Sa2151), and the Kiln Site (42Sa2160), Highway U-95 Archaeological Project; Blanding, Utah.

Crew member, archaeological survey of Strawberry Reservoir, Central Utah Project.

1973 - Teaching assistant at University of Utah Archaeological Field School, Evans Mound (42In40); Summit, Utah.

Supervisor, archaeological survey in eastern Utah (Ivie Creek, Ferron Creek and Bull Creek drainages).

1974 - Supervisor of an archaeological survey in Sevier, Emery and Garfield counties; eastern Utah.

In addition, I have done numerous short-term surveys in various parts of Utah.

Other Experience

1971-1974 Research assistant involved in artifact analysis and archaeological report writing, University of Utah.

Lithic analysis of material from Eastern Utah, University of Utah.

1971-1972 Teaching Assistant Department of Anthropology, Portland State University (position declined).

1972-1974 Teaching Fellow, Department of Anthropology, University of Utah; Salt Lake City, Utah.

1972-1973 Instructor, correspondence courses, Department of Anthropology (Cultural Anthropology, Civilization of the Aztecs, Civilization of the Maya, Peoples and Cultures of Africa, Southwestern Archaeology, North American Archaeology, North American Indians).

1974 NDEA Title IV Scholarship (March 15 to August 31. Instructor, Prehistoric Man in Western North America, Department of Anthropology, University of Utah.

Papers and Publications

1973 "Gnat Knoll." In Highway U-95 Archaeology: Comb Wash to Grand Flat. Gardiner F. Dalley, ed. Special Report of the Department of Anthropology, University of Utah; Salt Lake City, Utah.

1973 "Rattler's Midden." In Highway U-95 Archaeology: Comb Wash to Grand Flat. Gardiner F. Dalley, ed. Special Report of the Department of Anthropology, University of Utah; Salt Lake City, Utah.

1973 "The Kiln Site." In Highway U-95 Archaeology: Comb Wash to Grand Flat. Gardiner F. Dalley, ed. Special Report of the Department of Anthropology, University of Utah; Salt Lake City, Utah.

1973 Preliminary Report of an archaeological survey in Eastern Utah. Report submitted to the U. S. National Forest Service and Bureau of Land Management. Ms. on file at the Department of Anthropology, University of Utah, Salt Lake City, Utah.

1974 An Archaeological survey in the Ivie Ferron and Bull Creek drainages, Eastern Utah. Paper presented at departmental colloquiums, Department of Anthropology, University of Utah;Salt Lake City, Utah.

1974 An Archaeological survey in Emery, Sevier and Garfield counties, Eastern Utah. Preliminary report submitted to the National Science Foundation, U.S. National Forest Service and Bureau of Land Management. Ms. of file, Department of Anthropology, University of Utah, Salt Lake City, Utah.

Research Interests North American Archeology, Quaternary paleoecology, lithic technology, cultural ecology

STATEMENT OF PROFESSIONAL TRAINING, PUBLICATIONS, EXPERIENCE AND EMPLOYMENT

for

FLOYD A. O'NEIL

Personal Data

Name:	Floyd A. O'Neil
Address:	318 Second Avenue, Salt Lake City, Utah 84103
Telephone:	University of Utah, 581-7611; Home, 363-7491
Birthdate:	July 14, 1927
Birthplace:	Roosevelt, Utah
Marital Status:	Married
Wife's Name:	Shauna Holland O'Neil

Training and Professional Positions

1957:	B.S., University of Utah; History and Education
1973:	Ph.D. in History, University of Utah. Dissertation Title: "A History of the Ute Indians of Utah until 1890."
1957-61:	Teacher; Carbon County School District, Utah
1966:	Lecturer in History, Fort Lewis College, Durango, Colorado
1964-66:	Research Fellow in History, University of Utah
1967-71:	Assistant Director, Center for Studies of the American West. Specific duties: Research, oral history collection and documentation of American Indian History as part of the Duke Oral Indian History Project.
1972-74:	Associate Director for Documentation and Oral History Programs, American West Center, University of Utah
1974--	Associate Director for American West Center, University of Utah.

Publications

"An Anguished Odyssey: The Flight of the Utes 1906-1908." Utah Historical Quarterly, 1968.

"Fort Lewis Military Records," Colorado Magazine, 1969.

Historical Survey of the Upper Colorado River Basin. National Park Service. 1968.

Ute People: An Historical Study. University of Utah Press, 1969. (edited).

"Using Oral History as the Basis for Classroom Materials," English for American Indians. Spring, 1971.

"The Reluctant Suzerainty: The Uintah-Ouray Reservation." Utah Historical Quarterly, 1971.

The Southern Utes: A Tribal History. (edited). Southern Ute Tribe, Salt Lake City, Utah. 1972.

The Zunis: Self-Portrayals. By the Zuni People. Albuquerque, New Mexico: University of New Mexico Press, 1972. (Coordinator of the project which produced this work).

APPENDIX VI

References Cited

and

A Partially Annotated Bibliography of the Archeological Research in the Uinta Basin.

Aikens, C. Melvin

1966 Fremont-Promontory-Plains Relationships in Northern Utah. University of Utah Anthropological Papers, No. 82. Salt Lake City.

1967 Excavations at Snake Rock Village and the Bear River No. 2 Site. University of Utah Anthropological Papers, No. 87. Salt Lake City.

1970 Hogup Cave. University of Utah Anthropological Papers, No. 93, Salt Lake City.

Anderson, Duane C.

1967 Stone Balls of the Fremont Culture: An Interpretation. Southwestern Lore, Vol. 32, No. 4, pp. 79-81. Boulder.

Rejects interpretation held by many that the balls may have been part of a game used in connection with matching holes in rocks. Uses ethnographic date of reports of a juggling game played by the Utes, Paiutes, and Shoshoni to suggest that the stone Fremont balls may have been used in a similar type of juggling. "In view of the fact that similar balls were in widespread use in Historic time, it seems likely that the game was known to the Fremont people." Good example of misuse of ethnographic data. Photo of stone balls found in Dinosaur National Monument.

Anderson, Kathryn

1964 Dripping Rocks Cave Site. Southwestern Lore, Vol. 30, No. 2, pp. 26-35. Boulder.

Brief report on Elmer Smith's excavation of Cave, located just north of Rangeley. Nine levels evidently reported in Smith's notes, but is confusion over depths, correlations between trenches.
No pottery found, chipped stone includes 6 projectile points (triangular corner/side notched), 2 manos, 3 metates, "paint grinder," 10 bones (deer identified), red ochre.
Site is considered to be pre-Fremont (i.e., pre A.D. 400).
"Comparative material might be sought from Hells Midden and from the Uncompahgre Plateau."

Annand, Richard E.

1967 A Description and Analysis of Surface Collected Pottery from the Collbran Region, Colorado. Southwestern Lore, Vol. 33, No. 2, pp. 47-60. Boulder.

Report on a large surface collection collected over several years by amateurs in the Plateau Valley region near Grand Junction, comprising 996 sherds and 6 partially restorable vessels. Real problem placing this material in context since lithics were separated out, exact locations unknown, and archeology of area poorly known.

Three groups of sherds recognized and traits well-described for each. General comparative discussion; bulk of pottery considered to be Southern Paiute, and/or Ute. Discusses problems of identification.

Ambler, J. Richard

1966a Caldwell Village and Fremont Prehistory. Doctoral dissertation, University of Colorado. Boulder.

1966b Caldwell Village. University of Utah Anthropological Papers, No. 84. Salt Lake City. 118 pages, including appendices.

Largely a descriptive report on excavations at Caldwell Village including data on: pithouses: 22 found, circular, typically with 4 major roof supports, 12-27 ft. dia.,2 isolated hearths, 9 isolated pits, 7 borrow pits, 9 human burials, irrigation (?) ditch, 2 dog burials. Long descriptive section on artifacts recovered with reasonable number of pictures and charts. No distinction made between floor contact and fill material. Almost all pottery was Uinta Gray, a few sherds of Emery Gray, Anasazi types, uses latter to date occupation of village: A.D. 1050 to 1200. Projectile points appear to be almost all side notched. All metates are troughed with one open end, with one exception. Also recovered pipe frag. (limestone), stone balls, net sinker (?), 9 bird bone whistles, gaming pieces, wide variety of worked bone, olivella shell beads, basketry.
C-14 date of 1430±70 B.P. rejected as too early. (Charred roof timber on floor of pithouse GX0357)
Appendices: Human Skeletons, ABO Antigen Tests on Skeletons, Dog Skeletons, Faunal Remains (antelope considered the most important food source), Tree-ring Material, Maize.

1967 The Temporal Span of the Fremont. Southwestern Lore, Vol. 34, No. 4, pp. 107-117. Boulder.

ABSTRACT: Examination of the tree-ring, carbon-14, and ceramic data indicates that the entire Fremont development in Utah may be confined to the period between A.D. 1050 and 1200. Such dates for the Fremont are consistent with the hypothesis that Pueblo II traits reached the Virgin area about A.D. 1000, overlaying a basically Basketmaker III level of development, and thus both Pueblo - and Basketmaker-like traits could have spread farther north at the same time, providing the basis for the distinctive Fremont pattern. Extremely biased and dogmatic position, with faulty interpretation of much data, misunderstanding of many dating methods. Believes that the most reliable data concerning the dating of Fremont culture is derived from the association of Anasazi pottery in Fremont sites.

Baldwin, Gordon C.

1947 An Archaeological Reconnaissance of the Yampa and Green Rivers. The Kiva, Vol. 12, No. 3, pp. 31-36.

A brief report on a survey done in 1942 for the Park Service along a section of the Yampa and Green Rivers in Dinosaur National Park, concentrating in 3 areas: 1) Juniper Springs section of upper Yampa River, 2) Yampa River canyon from Lily Park to junction with Green River, 3) Green River canyon to Split Mt. 33 sites were found, but only a few are described in any detail and exact locations are not given. Important finds included campsites without pottery, eroding out of old river terraces in Juniper Springs area; Moss Shelter in Yampa Canyon with evidence of circular house floors; Castle Park sites with brief discussions of Cliff Canyon Cave (excavated in 1939-1940 by the Park Service); Marigold Shelter; Ruins in Poole Creek Canyon, Jones Creek, and Rainbow Park. More complete data is available on many if not all of these sites in other reports.

Baumhoff, Martin A., and J. S. Byrne
1959 Desert Side-notched Points as a Time Marker in California. Papers on California Archeology, No. 72, Reports of the University of California Archeological Survey, No. 48. Berkeley.

Beckwith, Frank
1931 Some Interesting Pictographs from Nine Mile Canyon, Utah. El Palacio, Vol. 31, No. 14, pp. 216-222. Santa Fe.

1932 Serpent Petroglyph in Nine Mile Canyon. El Palacio, Vol. 33. Nos. 15-16, pp. 147-149. Santa Fe.

1935 Ancient Indian Petroglyphs of Utah. El Palacio, Vol. 38, Nos. 6, 7, 8, pp. 33-40. Santa Fe.

n.d. The Head-Hunter Group of Petroglyphs near Vernal.

A description and personal interpretation of petroglyph panels at the McConkie Ranch in Dry Fork Valley. See various works by Schaafsma.

Berry, Michael S.
1972 The Evans Site. Special Report of the Department of Anthropology, University of Utah, Salt Lake City.

1974 The Evans Mound: Cultural Adaptation in Southwestern Utah. Unpublished M.A. thesis, on file, Department of Anthropology, University of Utah. Salt Lake City.

Binford, Lewis R., and George I. Quimby
1963 Indian Sites and Chipped Stone Materials in the Northern Lake Michigan Area. Fieldiana: Anthropology, Anthropological Series of the Field Museum of Natural History. Chicago.

Bolton, Herbert E.
1950 Pageant in the Wilderness. Utah Historical Quarterly, Vol. 18. Salt Lake City.

Breternitz, David A.

1965 Archaeological Survey in Dinosaur National Monument, Colorado-Utah, 1963-64. Ms. on file, Headquarters, Dinosaur National Monument.

Report on 1963-64 survey which recorded 405 sites. Majority of sites are "basically aligned with the Desert Culture," a few are identified as Ute or Shoshoni, others, especially in western part of Monument are Uinta Fremont. The 9 sites excavated in 1964 are not reported here, but data from them are used "to give substance to the various statements included" in report. Section listing all sites recorded (location, description, materials collected, remarks), descriptive section on materials collected with drawings (a little too brief).
Good base map showing areas covered during survey.
Only 16 of the sites recorded had Fremont pottery, and then only a few sherds (37 at most), 5 sites had Shoshonean pottery. All Fremont pottery was Uinta Gray. Only 2 sites with Anasazi pottery, 1 sherd at each. Pottery very scarce east of Castle Park.
One page of conclusions.
Brief addendum on 8 sites found in 1965.

1970a Archeological Excavations in Dinosaur National Monument, Colorado-Utah, 1964-1965. University of Colorado Studies, Series in Anthropology, No. 17. Boulder.

Compilation of the 22 sites excavated in 1964-65, with site reports written by individual students. These are reported by types of sites (Open Dwelling Sites Fremont, Dwelling Sites Wholly or Partially Fremont, Open Campsites, Rock Shelters).
Are a few problems: 1) many sites called Fremont have no pottery, 2) categories set up for lithic material, especially projectile points, are not consistently followed, creating some confusion. Swelter Shelter is reported to have had no natural stratigraphy. Circular argument used: there is a Fremont component, even though there is no ceramic material, since there is a rock art panel of a type "normally attributed to the Fremont people." No C-14 dates from shelters. Short summary and conclusions by Breternitz: important statement of what Breternitz believes to be the prehistoric culture history of area, with summary of C-14 dates from excavations--rejects early Fremont dates, discussion of Cub Creek Phase of Fremont Culture.

1970b "The Eastern Uinta Fremont" Paper presented at the Fremont Culture Symposium, 35th Annual Meeting of the Society for American Archeology, April 30-May 2, 1970. Mexico City, D.F., Mexico.

1971 The Eastern Uinta Fremont. Utah Archaeology, A Newsletter, Vol. 17, No. 1, pp. 1-20. (Paper presented earlier at the 'Fremont Symposium, Society for American Archaeology Meetings, Mexico City, D.F., April 30-May 2, 1970) Mexico.

Includes table of sites excavated by University of Colorado in Dinosaur National Monument including type of site and presumed cultural affiliation.
Discussion of Cub Creek Phase (traits, diagnostic artifacts, etc.). Discussion of the "2 distinct Fremont occupation levels at Deluge Shelter" i.e., specific traits found in each.
Section on radiocarbon dates. Rejects dates from Deluge Shelter as 200-300 years too old, discussion of C-14 dates from Uinta Basin, and the "old wood" hypothesis. More detailed discussion of same can be found in 1970 publication edited by Breternitz.

Brew, John O.
1946 Archaeology of Alkali Ridge, Southeastern Utah. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. 21. Cambridge.

Brown, F. Martin
1937 The Prehistoric Ruins of Castle Park. Southwestern Lore, Vol. 3, No. 2, pp. 22-28. Boulder.

Report of a survey of Yampa Canyon during 1933 by the Colorado Biol. Survey and the Fountain Valley School, specifically, Castle Park. Description of 5 cave sites--probably important as an index of what was still present in these caves. One, Mantle's Cave was later excavated by Burgh and Scoggin. Author discusses storage room construction and material found by Mrs. Mantle in these structures. Author evidently excavated part of the cave also, uncovering "five successive ceiling falls."
Conclusions: Park inhabited by agriculturalists who raised squash, 2 types of corn, no beans; wove excellent baskets and mattings; made poor pottery; were excellent workers in flint; built circular granaries and rectangular houses.

Burgh, Robert F.
1950 A Fremont Basketmaker in Dinosaur National Monument. Tree-Ring Bulletin, 16 (3):19-20. Tucson.

Brief note on archaeological context of beam dated by Schulman (1950). Collected in 1948 from house floor in Marigold Cave--1 of 4 dwellings excavated later by Dick in 1949. The cave features 1st mentioned in 1937 by Brown were found by Dick to be associated with the house floors. Gives floor features and artifacts.

Burgh, Robert F. and Charles R. Scoggin
1948 The Archaeology of Castle Park, Dinosaur National Monument. University of Colorado Studies, Series in Anthropology, No. 2. Boulder.

One of the major scientific works on excavations in NE Utah, especially for the Dinosaur National Monument. Has a good summary of other investigations in Castle Park. "This study is concerned in detail with the antiquities of Castle Park in the

Yampa Canyon, and more particularly with the excavation of Mantle's Cave. Our presentation is primarily descriptive and analytical, but we have attempted to relate local antiquities to those in neighboring areas."
Mantles Cave: 2 periods of occupation separated by extensive layer of rock fall.
Reports early test of Hells Midden (see Lister 1951 for complete report). Ch IV Aboriginal Culture: important for description of structures and artifacts found in Castle Park, including Mantle's Cave (feather and ermine headdresses) with good illustrations. Notes plain gray ware from Mantle's,Marigold and Barn Caves.
Ch V: Comparison of material with that from Great Basin, Plains, Colorado Plateau.
Conclusion: culture of Castle Park identical to Fremont of east-central Utah, basically Basketmaker in content. 7th century given as terminal date of occupation

Byers, Douglas S. (ed.)
1967 The Prehistory of the Tehuacan Valley, Volume 2: Non-Ceramic Artifacts. Austin: University of Texas Press.

Clewlow, C. William Jr.
1967 Time and Space Relations of Some Great Basin Projectile Point Types. Reports of the University of California Archaeological Survey, No. 70. Berkeley.

Crabtree, Don E. and B. Robert Butler
1964 Notes on Experiments in Flintknapping: 1. Heat Treatment of Silica Minerals. Tebiwa, Vol. 7, No. 1, pp. 1-6.

Crane, H. R. and J. B. Griffin
1958 University of Michigan Radiocarbon Dates III. Science, Vol. 128, pp. 1117-1123.

Site A:10:1, Moffat Co., Colorado. Uncharred corn cobs of predom. Mexican pyramidal type associated with beehive-shaped masonry granaries. No Pueblo artifacts, pottery, or architecture. Lithics resemble Shoshonean types M-285, 400±150 B.P.

Crouse, Hubert Y.
1954 A Folsom Point from the Uinta Basin, Utah. The Masterkey, Vol. 28, No. 2, pp. 50-51. Los Angeles.

Curry, Donald R. and David B. Madsen
1974 Holocene Fluctuations of Great Salt Lake. Paper delivered at the 1974 American Quaternary Association Meeting. Madison, Wisconsin.

Davis, Emma Lou and Richard A. Shutler, Jr.
1969 Recent Discoveries of Fluted Points in California and Nevada. The Nevada State Museum Anthropological Papers, No. 14. Carson City.

Day, Kent C.

1963 Preliminary Report of the Flaming Gorge Survey. Utah Archeology: A Newsletter, Vol. 8, No. 4, pp. 3-7. Salt Lake City.

Brief but good summary of survey conducted from 1958 to 1962 of the Flaming Gorge Reservoir. 121 sites recorded in reservoir area; 65 within pool area. Limited investigation of adjoining areas indicated significant aboriginal occupation. See UUAP's for complete reports.

1964 Thorne Cave, Northeastern Utah: Archaeology. American Antiquity, Vol. 20, No. 1, pp. 50-59. Salt Lake City.

Thorne Cave is a site in Cliff Creek Canyon, northeastern Utah. Between 5000 and 2000 B.C. alluvial fill in the canyon reached the level of Thorne Cave and formed its floor. At this time, and intermittently for perhaps the next 200 years, peoples with a Desert Archaic cultural tradition camped on a dune near the cave mouth while the canyon and the cave continued to fill. Stratified camp debris was washed into the cave, and alluvium accumulated well above the cave brow, leaving a dead space in the dome area of the cave roof. Dissection of canyon alluvium later re-exposed Thorne Cave and washed away much of the evidence of human occupation. Radiocarbon dated charcoal indicates that the site was occupied as early as 4230±250 years B.P. Materials recovered from Thorne Cave include redeposited charcoal and food-bone scrap; projectile points, small choppers and scrapers, manos, and grinding slabs; bone awls, needles, a pendant, a flaking tool, and a scapula seed-header; and impressions of twined basketry.
Article by H. Malde and A. Schick follows.

1965 Archaeological Survey of the Uintah Basin, Northeastern Utah. Special Report prepared in connection with NSF Grant GS-652 (dittoed). Department of Anthropology, University of Utah, Salt Lake City.

Day, Kent C. and David S. Dibble

1963 Archeological Survey of the Flaming Gorge Reservoir Area, Wyoming-Utah. University of Utah Anthropological Papers, No. 65, Upper Colorado Series, No. 9. Salt Lake City.

Dick, Herbert W.

1949 Report on Archaeological Research in the Yampa and Green River Canyons, Dinosaur National Monument, 1949. MS on file at Dinosaur National Monument Headquarters. Jensen.

1950 Report of Archaeological Research in the Yampa and Green River Canyons, Dinosaur National Monument and Adjacent Areas, 1950. MS on file at University of Colorado Museum. Boulder.

n.d. The Archaeology of Marigold's Cave, Castle Park, Dinosaur National Monument. Unpublished MS on file, University of Colorado Museum. Boulder.

Ferguson, C. W., Jr.

1949 Additional Dates for Nine Mile Canyon, Northeastern Utah. Tree-Ring Bulletin, Vol. 16, No. 2, pp. 10-11. Tucson.

New dates on archaeological material from J. Gillin's excavation of Sky House in Nine Mile Canyon, in 1936.

Fewkes, J. Walter

1917a Archaeological Investigations in New Mexico, Colorado, and Utah. Smithsonian Miscellaneous Collections, Vol. 68, No. 1, pp. 1-38. Washington.

1917b Prehistoric Remains in New Mexico, Colorado, and Utah. Smithsonian Miscellaneous Collections, Vol. 66, No. 17, pp. 76-92. Washington.

Flint, Richard F. and Edward S. Deevey, Jr. (eds.)

1959 American Journal of Science, Radiocarbon Supplement, Vol. 1. New Haven. (p. 189 for Ivie Creek dates)

Fowler, Don D.

1968 Archeological Survey in Eastern Nevada, 1966. Desert Research Institute Social Sciences and Humanities Publications, No. 2. Reno.

Fowler, Don D., D. B. Madsen and E. M. Hattori

1973 Prehistory of Southeastern Nevada. Desert Research Institute Publications in the Social Sciences, No. 6. Reno.

Frison, George C.

1968 Site 48SH312: An Early Middle Period bison kill in the Powder River Basin of Wyoming. Plains Anthropologist. Vol. 13, No. 39, pp. 31-39. Lincoln.

Gaumer, Alfred E.

1937 Basketmaker Caves in Desolation Cañon, Green River, Utah. The Masterkey, Vol. 11, No. 5, pp. 160-165. Los Angeles.

Excavated 3 caves and a single room of a slab-house ruin— exact location unclear; may actually be in side canyons. Salvaged rabbit snares and clay figurines from one cave. Major cave in side canyon 500 ft. from spring, in pinyon juniper zone. Cave contained slab-lined circular cist with following material in it: basket, black bean, atlatl points, flaking tools, other lithic materials. Also in cave: metates, manos, corn, baskets, child burial with small dog. Over 2000 beads with burial, some slate. No pottery except a few sherds of plain gray ware at spring. Numerous sherds of plain gray ware, black on white found at slab-house, wherever that is.

Gillin, John

1938 Archaeological Investigations in Nine Mile Canyon, Utah. University of Utah Bulletin, Vol. 28, No. 11. Salt Lake City.

Recognized as an important contribution to Basin and Southwestern archeology. Describes excavations undertaken in 1936; 3 types of sites, differentiated on the basis of situation and house construction. Well known sites excavated include Valley Village, Sky House, Lookout House. Valuable descriptions of artifacts associated with the different sites is included.
Author believes structures noted by the 1936 expedition are the work of Pueblo peoples, who preserved some Basketmaker traits. Area was occupied earlier by Basketmaker peoples who were responsible for distinctive pictographs found in the canyon.
Beams from Sky House yielded outer ring date of 768 A.D. and inner ring date of 397 (reported by Schulman in 1948), providing a link to beams from the 5th and 6th centuries in Arizona.

1941 Archeological Investigations in Central Utah. Paper of the Peabody Museum of American Archaeology and Ethnology, Vol. 17, No. 2. Cambridge. (50 pages plus plates)

Report on 1937 excavations in Utah by University of Utah and Peabody Museum. An extremely important contribution to the archeology of Utah and for understanding (at that time) the Northern Periphery.
Marysvale: Description of excavation of only sites left near Marysvale with good plans of pit structures. Comparison with structures excavated earlier by Steward very valuable.
Ephraim: valuable description of 3 sites excavated, previously examined by Elmer Smith.
Tooele: excavation of one site near Tooele.
Valuable and significant section on "House Types of the Northern Periphery in Utah"--classic early statement. Useful trait list of Utah sites with references. Good section on artifacts recovered in excavations with lengthy section on pottery.
Appendix: analysis of animal bones
There is also brief mention of pictographs in Clear Creek Canyon.

Guernsey, Samual J. and Alfred V. Kidder

1921 Basketmaker Caves of Northeastern Arizona. Papers of the Peabody Museum of American Archaeology and Ethnology. Harvard University, Vol. 8, No. 2. Cambridge.

Gunnerson, James H.

1956 A Fluted Point Site in Utah. American Antiquity, Vol. 21, No. 4, pp. 412-14. Salt Lake City.

1957a An Archeological Survey of the Fremont Area. University of Utah Anthropological Papers, No. 28. Salt Lake City.

Report of important survey work done in Eastern Utah north of the Anasazi area from 1954 through 1956, and excavations and tests made at 4 sites in the Fremont Junction-Emery area (excavations more fully reported in Taylor, 1957 and Aikens, 1967). Site descriptions grouped by area: Uinta Foothills, White River, High East Tavaputs, Hill, Willow and Florence Creeks, Nine Mile Canyon, Range Creek Canyon, Thompson Wash, Robbers' Roost, Hanksville, Boulder-Escalante, Sandy Ranch, Tantalus and Pleasant Creeks, Fremont River, Last Chance Creek, Ivie Creek, Oak Spring Ranch, Quitchupah Creek, Muddy River, Ferron Creek. Separate chapter on artifacts collected from all sites.
Because of his preoccupation with "Fremont," almost all sites are considered as Fremont with a few exceptions, the ascription of many sites must be open to question because of his assumptions (see Gunnerson 1969). Nevertheless, this is a valuable inventory of sites.

1957b Uinta Basin Archeology. In Seal, Otto G. (ed.), Guidebook to the Geology of the Uinta Basin, Eight Annual Field Conference, Intermountain Association of Petroleum Geologists, pp. 15-16.

1969 The Fremont Culture: A Study in Culture Dynamics on the Northern Anasazi Frontier. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, Vol. 59, No. 2. Cambridge.

An important work mainly because it is the only complete report on the archaeological reconnaissance and test excavations made by the Claflin-Emerson expedition of the Peabody Museum from 1927 through 1931. Sites and data are presented by area: Kaiparowits Plateau, Escalante Drainage, Glen Canyon, Trachite Creek-North Wash, Ruin Park-Salt Creek-Fort Bottom, Dirty Devil River-Waterhole Flat, Barrier Canyon, Fremont River Drainage, Muddy River Drainage, Desolation Canyon,Range Creek Canyon, Nine Mile Canyon, Florence and Chancler Creeks, Hill and Willow Creeks, Uinta Mountain Foothills. This early (unpublished, largely) work provides extremely valuable data in the form of artifact distribution, plans of sites with masonry structures, excavation of caves, etc.
Other sections on Fremont Culture (equated with what is now called Uinta and San Rafael variants of the Fremont culture) comprised of trait lists and authors personal interpretations of the Fremont Culture submitted as his dissertation. Ignores all work after 1963. Many of his ideas not acceptable now.

Haynes, C. Vance
1971 Developments in Early Man Studies in Western North America, 1960-1970. Arctic Anthropology, Vol. 8, No. 2. Univesity of Wisconsin Press. Madison

Heizer, Robert F., and Martin A. Baumhoff
1961 The Archaeology of Wagon Jack Shelter. University of California Anthropological Records, Vol. 20, No. 4. Berkeley.

Hester, Thomas R.
1973 Chronological Ordering of Great Basin Prehistory. University of California Archaeological Research Facility, Contributions 17. Berkeley.

Howard, Edgar B.
1943 The Finley Site: Discovery of Yuma Points, in situ, Near Eden, Wyoming. American Antiquity, Vol. VIII, No. 3. Menasha.

Hurst, C. T.
1942 Completion of Work in Tabeguache Cave. Southwestern Lore, Vol. 8, No. 1. Boulder.

1943 Preliminary Work in Tabeguache Cave II. Southwestern Lore, Vol. 9, No. 1. Boulder.

1945 Completion of Excavations of Tabeguache Cave II. Southwestern Lore, Vol. 2, No. 1. Boulder.

1947 Eight Years in the Tabeguache Country. University of New Mexico Press, Alburquerque.

Hurst, Blanch H.
1957 A Comparative Study of the Peripheral Excavation of C. T. Hurst. Southwestern Lore, Vol. 23, No. 2, pp. 1-31.

Hunt, Alice P.
1953 Archaeological Survey of the LaSal Mountain Area, Utah. University of Utah Anthropological Papers, No. 14. Salt Lake City.

Hunt, Alice P. and Dallas Tanner
1960 Early Man Sites Near Moab,Utah. American Antiquity, Vol. 26, No. 1, pp. 110-112. Salt Lake City.

Huscher, Harold
1939 Influence of the drainage pattern of the Uncompahgre Plateau of the Movements of primitive People. Southwestern Lore, Vol. 5, pp. 22-41. Boulder.

Husted, Wilfred M.
1969 Bighorn Canyon Archeology. Smithsonian Institution River Basin Surveys, Publication in Salvage Archeology, No. 12. Washington.

Irwin, Henry T.
1971 Developments in Early Man Studies in Western North America, 1960-1970. Arctic Anthropology, Vol. 8, No. 2. University of Wisconsin Press. Madison.

Irwin, H. J. and C. C. Irwin
1959 Excavation at the LoDaisKa Site in the Denver, Colorado Area. Proceedings of the Denver Museum of Natural History, No. 8. Denver.

Jeancon, Jean Allard
1927 Antiquities of Moffat County, Colorado. The Colorado Magazine Vol. 4, pp. 19-27.

A brief, rather vague, account of an expedition undertaken by the author in 1924 to check out reports he had read about so-called cliff dwellings and ruins reported in Dinosaur Natl Monument after reading an account published in 1921 in Steamboat Pilot. The full text of that article is given in this article.
Only area explored and reported by Jeancon is Lizard Canyon--2 caves with masonry storage structures in form of truncated cones. Only material reported is corn, no pottery.
Interesting account of hardships involved in archaeological work in the 1920s.

Jennings, Calvin H.
1968 The Paleo-Indian and Archaic Stages in Western Colorado. Southwestern Lore, Vol 34, No. 1, pp. 11-20.

Topic of paper is occupation of West Colorado prior to Fremont and Basketmakers. Places the beginning of the known cultural sequence in West Colorado after 9000 B.C. Lists Folsom surface finds with biblio references; reasonable discussion of other early finds in West Colorado and adjacent areas with references. Under Desert Archaic section--discussion of Thorne Cave, Hells Midden, Lowell Spring Site, Taylor Site, other sites in the Uncompahgre area. Uses a C14 date of A.D. 850 (1100 ± 250 B.P.) (Rubin & Seuss 1955) taken by C. Hunt from "a hearth in alluvium along East Creek, Unaweep Canyon...the hearth is 6 ft. below the top of the alluvium..." to date Uncompahgre Complex as before this date.
Discussion and references for Hurst's excavations in the Dolores drainage.

Jennings, Jesse D.
1957 Danger Cave. University of Utah Anthropological Papers, No. 27. Salt Lake City.

1966 Glen Canyon: A Summary. University of Utah Anthropological Papers, No. 81. Salt Lake City.

Johnson, Alfred E.
1974 Settlement Pattern Variability in Brush Creek Valley, Platte County, Missouri. Plains Anthropologist, Vol. 19, No. 64. Topeka.

Kehoe, T.F.
1966 The Small Side - Notched Point System of the Northern Plains. American Antiquity, Vol. 31, No. 6. Salt Lake City.

Kidder, Alfred V. and Samual J. Guernsey

1919 Archaeological Explorations in Northeastern Arizona. *Bureau of American Ethnology*, Bulletin 65. Washington.

Lamb, Sidney M.

1958 Linguistic Prehistory in the Great Basin. *Intermountain Journal of American Linguistics*, Vol. 24, No. 2, pp. 95-100.

Lanning, Edward P.

1963 Archaeology of the Rose Springs Site, 1NY-372. *University of California Publications in American Archaeology and Ethnology, Vol. 49, No. 3.* Berkeley.

Leach, Larry L.

1966a Excavations at Willowbrook: A Stratified Site Near Morrison. *Southwestern Lore,* Vol. 32, No. 2, pp. 25-46.

1966b The Archeology of Boundary Village, *University of Utah Anthropological Papers*, No. 83, Miscellaneous Collected Papers, No. 13. Salt Lake City. pp. 85-129.

Descriptive report of 1964 excavations at Boundary Village, located on Cub Creek 9 house units excavated; 2 basic types of structures were distinguished based on differences in typle and stratigraphic relationships (note that the stratigraphic relationships of superimposed structures were reversed in drawinss when compared to description). Section on lithic materials poor, drawings are not good--projectile points evidently stemmed, corner notched and side notched. All ceramics (378) sherds) are Uintah Gray, 2 surface sherds apparently Shoshone. No provenience charts.
Site considered to be aligned with "the mature period of the Fremont culture, A.D. 1000 to 1150", but no C-14 or dendro dates were run.
Three cultural levels were postulated, 2 Fremont differentiated by architectural style and stratigraphy, the third (rock filled fire pits) considered to be Ute.

1970 Archeological Investigations at Deluge Shelter (42Unl). Ph.D. dissertation, on file, University of Colorado. Boulder.

Leh, L.L.

1936. Prehistoric Ruins in Range Creek Canyon, Utah. *University of Colorado Studies*, Vol. 23, pp. 159-168. Boulder.

An important work on archaeological remains in Range Cr. as of 1934. All the sites reported are found along a 15 mile stretch of Range Creek or back from the main canyon a few hundred yds. in side canyons (Bear Canyon, Nelson Canyon). No sites noted in the lower end of Range Cr. Canyon or along the Green River from Range Creek to Price River.

Nine sites (some represent adjacent groups of structures) reported, all similar masonry and adobe storage structures built in ledges above the canyon. Good description of construction methods. Corn only reported material. Some of the structures totally inaccessible.
Almost all the pottery recovered (40 fragments) found near one site, evidently carried there by water. Description does not make clear what types were present--sounds like Sevier Gray, a black on gray, Emery Gray?, also a corrugated ware, and incised ware.

Lindsay, Alexander J. Jr., J. Richard Ambler, Mary Anne Stein, and Philip Habler
1968 Survey-Excavations North and East of Navajo Mountain, Utah, 1959-1962. Museum of Northern Arizona Bulletin, No. 45, Glen Canyon Series, No. 8. Flagstaff.

Lipe, William D. and R.G. Matson
1973 Archaeology & Alluvium in the Grand Gulch and Cedar Mesa Area, Southeastern Utah. Manuscript on file, Utah State Historical Society.

Lister, Robert H.
1951 Excavations at Hells Midden, Dinosaur National Monument. University of Colorado Studies, Series in Anthrolopolgy, #3. Boulder.

Important report on excavations at a stratified open site in Castle Park. "The culture of the upper portion of Hells Midden is identified with the Fremont River culture, but stratigraphically earlier deposits indicate the presence of pre-horticultural, pre-pottery horizons represented by a series of stone and bone artifacts extending to a depth of 4.55 meters below the surface of the midden." No dates available for the site. Fremont levels yielded corn, small corner notched points, calcite tempered pottery (only 40 sherds).
Levels below Fremont levels interspersed with non-occupational levels and have been divided arbitrarily into a sequence of 3 hunting/gathering stages. Upper stage characterized by stemmed, indented base points. Much less material available below Fremont levels, and nothing diagnostic in lower levels.

Lister, Robert H., and Herbert W. Dick
1952 Archaeology of the Glade Park Area: A Progress Report. Southwestern Lore, Vol. 17, No. 4, pp. 69-92.

Lohr, Edison P.
1948 Winter Dig in Yampa Canyon. Desert Magazine April.
Popular account of Scoggin and Lohr's excavations and survey in Castle Park, concern on Mantles Cave. Lots of information on hardship conditions, etc. See Mantle's Cave Report,

MacLeod, R. Bruce
1959 Supplemental Report of Robert D. Stirland's Reconnaissance in the Jones Hole Area. Manuscript on file, Dinosaur National Monument Headquarters.

McCandless, L. S.
1921 Explorations in Castle Park, Colorado. Steamboat Pilot.

Article is published in entirety in Jeancon (1927).

Madsen, David B.
1975 Dating Paiute-Shoshoni Expansion in the Great Basin. American Antiquity, Vol. 40, No. 1, pp. 82-86. Washington.

Madsen, David B. and Michael S. Berry
1975 A Reassessment of Northeastern Great Basin Prehistory. American Antiquity, in press. Washington.

Marwitt, J. P.
1970 Median Village and Fremont Culture Regional Variation. University of Utah Anthropological Papers, No. 95. Salt Lake City.

Marwitt, John P., Gary F. Fry and James M. Adovasio
1971 Sandwich Shelter. Great Basin Anthropological Conference, 1970, Selected Papers, C. Melvin Aikens (ed.), University of Oregon Anthropological Papers, No. 1. Eugene.

Meighan, Clement W. and C. Vance Haynes
1968 New Studies on the Age of the Borax Lake Site. The Masterkey, Vol. 42, No. 1. Los Angeles.

1970 The Borax Lake Site Revisited. Science, Vol. 167. Washington.

Miller, Wick R., James Tanner and Lawrence Foley
1969 A Lexicostatistic Study of Shoshoni Dialects. Anthropological Linguistics, Vol. 13, No. 4, pp. 142-164.

Montgomery, Henry
1894 Prehistoric Man in Utah. The Archaeologist, Vol. II, pp. 227-343. Waterloo, Indiana.

Morris, Earl H.
1939 Archaeological Studies in the La Plata district, southwestern Colorado and northwestern New Mexico - with an appendix, "Technology of La Plata Pottery," by A. O. Shepard. Carnegie Institution of Washington, Publication 519. Washington.

Morris, Earl H. and Robert F. Burgh
1954 Basketmaker II Sites Near Durango, Colorado. Carnegie Institution of Washington, Publication 604. Washington.

Morris, Richard, Ellen Glazier, Robert Thallon, and Marie Wormington
1937 The Canyon of Lodore-Yampa River Reconnaissance of 1936. Trail and Timberline, Vol. 219, pp. 3-14.

Morss, Noel
1931 The Ancient Culture of the Fremont River in Utah. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. 12. Cambridge.

1954 Clay Figurines of the American Southwest. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. 49, No. 1. Cambridge.

Mulloy, William
1954 The McKean Site in Northeastern Wyoming. Southwestern Journal of Anthropology, Vol. 10, pp. 432-460.

1958 A Preliminary Historical Outline for the Northwest Plains. University of Wyoming Publications, Vol. 22, Nos. 1 and 2. Laramie.

Olson, Edwin A. and W.S. Broecker
1959 Lamont Natural Radiocarbon Measurements. American Journal of Science Radiocarbon Supplement, Vol. 1, pp. 21-22. New Haven.

Pendergast, David M.
1963 Addendum I: Lithic Materials from Southwestern Wyoming and Northeastern Utah. In Archeological Survey of the Flaming Gorge Reservoir Area, Wyoming-Utah, by Kent C. Day and David S. Dibble. University of Utah Anthropological Papers, No. 65, Upper Colorado Series, No. 9. Salt Lake City.

Brief description of 2 surveys undertaken in 1960 and 1961. The first was to accompany Jose Cruxent to the southwest Wyoming area to examine and collect artifacts believed to represent the Pre-Projectile Point Stage.
The second was a survey of the proposed Ouray Wildlife Refuge, especially areas along the Green River to be flooded or altered. Only 1 site found, plus 4 areas where scattered artifacts were found. Artifacts all lithic; none especially diagnostic.

Pradt, A.G.
1972 Rock Art of the Uintah Basin. Uintah Basin Standard Publications Company. Roosevelt, Utah.

Purdy, William M.
1959 An Outline History of the Flaming Gorge Area. University of Utah Anthropological Papers, No. 37, Upper Colorado Series, No. 1. Salt Lake City.

Appendix of report shows results of initial survey conducted in 1958 of the portion of the proposed Flaming Gorge Reservoir lying in Daggett County. Published in full in Day and Dibble, 1963.

Ranere, Anthony J.

1971 Birch Creek Paper No. 4: Stratigraphy and Stone Tools from Meadow Canyon, Eastern Idaho. Occasional Papers of the Idaho State University Museum, No. 27. Pocatello.

Reagan, Albert B.

1931 a Ancient Writings North of the Rio Grande. Roger Williams Naturalist, Vol. 3, No. 4. pp. 1-6.

1931 b Ruins of Dawning Age Found in Northeastern Utah. Science Service, December 8, 1930. Science Newsletter, January 3, 1931.

1931 c Archaeological Finds in the Uintah Basin, 1931. Reports, Archaeological Field Work in North America During 1931. Committee on State Archaeological Surveys, p. 41. Ann Arbor.

1931 d Some notes on the Picture Writing North of Mexico. Bulletin, Wagner Free Institute of Science of Philadelphia, Penn., Vol. 7, No. 4, pp. 38-54.

1931 e Early House Builders of the Brush Creek Region in Northeastern Utah. American Anthropologist, Vol. 33, No. 4. pp. 660-61.

Very brief description of squarish houses from Brush Creek country - location not given.
Undressed river cobbles, chinked with mud mortar 15-25' on a side. Resemble Class A houses of Piedra district. Around them - small circular structure, stones, stone-edged circles.
Gray ware found around them - numerous lithic material.

1931 f The Pictographs in Ashley and Dry Fork Valleys, in Northeastern Utah. Transactions, Kansas Academy of Science, Vol. 34, pp. 168-216. Topeka.

Description and bizarre interpretation of over 100 rock art panels in Vernal area. Although directions are sketchy, most of the panels can probably be located. Many of the panels are on the McConkie Ranch in Dry Fork Valley.
The panel numbers are still visible today.
A few interesting photographs.
This is probably a good basic list of the rock art in the area, but the meanings ascribed to the art and their presumed cultural affiliations shouldn't be taken too seriously.
See Schaafsma's work for discussion of Vernal rock art.

1931 g Ruins and Pictographs in Nine Mile Canyon, Utah. Transactions, Illinois State Academy of Science, Vol. 24, No. 2, pp. 369-70.

Brief, rather vague discussion, mainly concerned with "forts" and "towers" in vicinity of Nutter Ranch, as well as "rock writings."
Of little use.

1931h Some Archeological Notes on Nine Mile Canyon, Utah. El Palacio, Vol. 31, No. 4, pp. 45-71. Santa Fe.

1931i Collections of Ancient Artifacts from the Ashley-Dry Fork District of the Uintah Basin, With some Notes on the Dwellings and Mortuary Customs of the Ute Indians of the Ouray (Utah) Region. El Palacio, Vol. 31, No. 26, pp. 407-13. Santa Fe.

1931j Some Archeological Notes on Hill Canyon in Northwestern Utah. El Palacio, Vol. 31, No. 15, pp. 223-44. Santa Fe.

1931k Some Notes on the Ancient Earth-Lodge Peoples of the Willard Stage of Pueblo Culture in the Uintah Basin, Utah. El Palacio, Vol. 30, Nos. 19-20. Santa Fe.

1931l Addition Archeological Notes on Ashley and Dry Fork Canyons in Northwestern Utah. El Palacio, Vol. 31, No. 8, pp. 122-31. Santa Fe.

1931m Nine Mile Canyon, A Review. Discoveries, Vol. 2, No. 2, p. 8.

1931n Rock Writings in Utah. Discoveries, Vol 2, No. 3, p. 6.

1931o Archeological Notes on the Brush Creek Region, Northeastern Utah. The Wisconsin Archeologist, Vol. 10, No. 4, pp. 132-38.

1931p Caves of the Vernal District of Northeastern Utah (Abstract). Proceedings of the Utah Academy of Sciences, Arts and Letters, Vol. 10, pp. 13-18. Salt Lake City.

1931q Indian Pictures in Ashley and Dry Fork Valleys, in Northeastern Utah. Art and Archaeology, Vol. 34, No. 4, pp. 200-5, 210.

1932a The Ancient House People of the Brush Creek Region, in Northeastern Utah. Proceedings of the Iowa Academy of Science for 1931, pp. 183-4.

1932 b Archaeological Finds in the Uintah Basin in Utah. The Wisconsin Archaeologist, Vol. 11, pp. 162-171.

1932 c Ruins and Pictographs in Nine Mile Canyon, Utah. Transactions of the Illinois State Academy of Science, Vol. 24, No. 2, pp. 369-70.

Very brief general paper on the forts, caches, cliff-houses, square-houses, and towers (all considered Puebloan) in Nine Mile Canyon, as well as the numerous pictographs (considered Puebloan and Basket Maker). Not of much use.

1932 d Archaeological Finds in Northeastern Utah. Iowa Academy of Science, Vol. 40, pp. 131-132.

Very brief paper in which Reagan states some of his stranger ideas concerning the Basket Makers, Pueblo peoples, Head Hunters, etc.

1932 e The Ancient Agriculturalists of Brush Creek Valley, in Northeastern Utah. Frontiers, Vol. 12, No. 2, pp. 174-6.

1932 f Finds in the Uintah Basin, in Utah, in 1931. American Anthropologist. Vol. 34, No. 3, p. 505.

One paragraph stating that work is being done and 4 successive peoples occupied basin.

1933 a Anciently Inhabited Caves of the Vernal, Utah District with Some Additional Notes on Nine Mile Canyon, Northeast Utah. Transactions, Kansas Academy of Science, Vol. 36, pp. 41-70. Topeka.

This brief article, even though it is written by Reagan (who has to throw in all his strange ideas about prehistoric cultures), is extremely important in that it lists 40 caves or cave groups in the Ashley/Dry Fork region that are evidently not mentioned elswhere. The descriptions and locations, are scanty, but most could probably be located. Almost all had already been vandalized, but Reagan lists the material in private collections from each. Corncobs, large pumpkin storage vessels, pumpkin seeds. Large quantities of baskests, woven jugs, other perishable material were recovered. He mentions no pottery. A large number of caves had cists or some kind of structures. The entire occupation of these caves (excluding the possibility that some have very early deposits) seems to have been by populations at a Basketmaker II level of technology.

Notes on Nine Mile: apparently describing the same sites found by the Claflin-Emerson Expedition (see Gunnerson 1969). A rather lengthy section on rock art adjacent to Rasmussen Cave and in Cottonwood Wash. Probably are also described by Gunnerson (1957, 1969) and Schaafsma.

1933 b The Basket Makers and the People of the Ancient Culture of the Fremont River in Utah. Northwest Science, Vol. 8, No. 3.

Appears to be a very general discussion for laymen with no specific data.
Not very useful.

1933 c Some Notes on the Snake Pictographs of Nine Mile Canyon, Utah. American Anthropologist, Vol. 35, No. 3.

One-page brief description with drawing of snake pictographs in Nine Mile, and comparisons with Plumed Serpent of Yucatan. See various works by Schaafsma.

1933 d Evidence of Migration in Ancient Pueblo Times. American Anthropologist, Vol. 35, No. 1, pp. 206-7.

1933 e Report of Archaeological Field Work During 1932. American Anthropologist, Vol. 35, No. 3, p. 508.

1933 f Summary of Archeological Finds in the Uintah Basin, in Utah, to date. Utah Academy of Science, Arts, and Letters, Vol. 10 pp. 3-18. Salt Lake City.

General, but vague, discussion of sites in Ashley/Dry Fork Valleys, Brush Creek/Greendale region, Nine Mile Canyon rock shelters south of Myton, village site on Rock Creek--north of Myton, Hill Creek Canyon. Discusses successive occupation of areas by Basketmakers, Pueblo and Fremont groups and what the author considers to be distinctive of each. Fremont groups are called 'Head Hunters," associated with head hunter pictographs. Reagan examined 11 small villages with wattle and daub houses in Vernal, La Pointe and Brush Creek areas--no details given. Mentions extensive irrigation and storage reservoirs. Discusses masonry houses, forts, towers, buildings on eminences in following areas with very brief descriptions: Nine Mile Canyon, Hill Creek Canyon. Notes scantiness of pottery at Hill Creek sites. Interesting, but not very helpful.

1934 a Evidence of Possible Migration in the Very Dawning Period of Pueblo Culture. Primitive Man, Vol. 7, pp. 12-14.

1934 b Some Ancient Indian Granaries. *Utah Academy of Science, Arts and Letters*, Vol. 11, pp. 39-42. Salt Lake City.

Very brief discussion of granaries in Florence Creek (23) and Chandler Creek (28). Built in niches or small caves, described as 'most all as near a truncated-oval-cone as the space would permit." Similar to those described by Kidder and Guernsey in Monument Valley.
No description of material found in garnaries, or any details on location. Two pictures--one of granary (in Monument Valley?), one of material from several granaries--can't see too much. Interesting, but not very helpful.

1934 c Some Notes on the History of the Uinta Basin in Northeastern Utah, to 1850. *Utah Academy of Science, Arts and Letters*, Vol. 11, pp. 55-64. Salt Lake City.

Mainly quotes from journals and diaries of early white traders, explorers who visited Uinta Basin in 1830's to 1840's. Concentrates on activities of Robidoux at Ft. Uintah at White Rocks. Some mention of Indians in area, mainly in relation to trade items.
Does not appear to be too useful for archeological purposes, although original sources may provide information on location of settlements.

1934 d Additional Archaeological Notes on the Uintah Basin, in Northeastern Utah. *Transactions of the Kansas Academy of Science*, Vol. 37, pp. 39-54.

Description of work done in 1933: principally in Florence and Chandler Canyons but also in Hill Creek Canyon and some of its larger tributaries. Maps and description are adequate enough so that the sites could probably be located approximately, and some fairly precisely. Discusses large "cliff house residences" in Florence Canyon in shelters and caves, yielding pottery, corn, and numerous granaries. A total of 15 cliff house groups.
Also briefly describes rock art. Finds in Chandler Canyon consisted of granaries, nothing he classified as residences. Briefly describes granaries and masonry structures in Hill Creek Canyon, especially near confluence with Horsecorn Canyon. All of these are probably the sites located earlier by the Claflin-Emerson Expedition and reported by Gunnerson (1957, 1969).

1934 e Archaeological Field Work in Utah. *Archaeological Field Work in North America in 1933*. Circular Series 18, pp. 40-41.

1935 a Archeological Report of Field Work Done in Utah in 1934-35. *Utah Academy of Science, Arts and Letters*, Vol. 12, pp. 50-88. Salt Lake City.

n.d. Survey Report of the Rock Art of Utah. MS on file, Utah State Historical Society. Salt Lake City.

Schroeder, A. H.

1955 Pottery from the Collbran, Colorado Area. In A Reappraisal of the Fremont Culture. Proceedings of the Denver Museum of Natural History, No. 1, pp. 133-135. H. M. Wormington. Denver.

Brief report of small surface collections from Collbran, Sunnyside, and Westwater, Colorado, all of which is identified as Ute. Some are whole pots.

Schulman, Edmund

1948 Dendrochronology in Northeastern Utah. Tree-Ring Bulletin, Vol. 15, Nos. 1 and 2, pp. 2-14. Tucson.

An important work for understanding tree-ring dating in northeastern Utah. Discussion of species available for dating, their relationship to specific climatic conditions in the area, and the trees used to establish a dendro sequence in northeastern Utah (both living trees and archeological specimens). Discussion of the archeological collections available for dating--provenience, problems, etc.--from Nine Mile Canyon, Hill Creek Canyin, Dinosaur National Monument, Peabody Museum Collection. Important table of all dated specimens in northeastern Utah. Material from Nine Mile provided key link in setting up the sequence from archeological to living trees.

1950 A Dated Beam from Dinosaur National Monument. Tree-Ring Bulletin, Vol. 16, No. 3, pp. 18-19.

Pinyon pine from Marigold Cave gave ring history from A.D. 426 to 690+. Cutting date somewhat conditionally est. at 750±50. Farthest north extension of the southwestern ring chronology.

1951 Miscellaneous Ring Records III. Tree-Ring Bulletin, Vol. 17, No. 4, pp. 28-29.

Table of dates from specimens excavated in Nine Mile and Hill Creek Canyons.

Scoggin, Charles R.

1941 Report of Reconnaissance in Dinosaur National Monument, Season 1941. Ms on file, Dinosaur National Monument Headquarters.

Scott, Donald

1932 Report on Peabody Museum Activities in Northeastern Utah in 1931. American Anthropologist, Vol. 34, pp. 505-806. Menasha

Short report stating where Claflin-Emerson expedition had been working and general statements on what found (see Gunnerson 1969).

Includes a lengthy discussion of the numerous mounds that were in the process of being destroyed in the Provo. A reasonably good discussion (considering that it is Reagan) of their location within the valley and some of the material recovered from them.
Brief discussion of ruins and pictographs visited in Nine Mile Canyon. Also visited Desolation Canyon, Ouray area, and Hill Creek but no discussion except to mention one ruin on Hill Creek, 18 mi. south of Ouray.
Rather lengthy discussion plus figures, of pictographs in Nine Mile Canyon. Includes some of his strange interpretation of rock art. Discussion and figures of pictographs at Lincoln Beach (Utah Lake), Goshen, Santaquin, Cedar Fort, Fairfield.
Field work in mounds near Utah Lake--Hinkley Farm and adjacent areas. Discussion of associated artifacts
Discussion of field work at Nephi, Buckhorn Draw, Bull Hollow Wash (Cleveland). Interesting, but difficult to know what to make of all this.

1935 b Petroglyphs Show that the Ancients of the Southwest Wore Masks. American Anthropologist, Vol. 37, pp. 707-708.

1935 c Two Rock Pictures and their Probably Connection with the "Pied Piper" Myth of the Indians. The Colorado Magazine, Vol. 12, No. 2, pp. 55-59.

1937 a Ancient Utah People Seem to Have Believed that Snakes Evolved from an Animal. Wisconsin Archaeologist, Vol. 15, No. 2, p. 44.

1937 b Investigations of the Uintah Basin and Pueblo II Type Culture in the Uintah Basin, Mentioned. Summary of Archaeological Work in the Two Americas. Archaeological Series, No. 7, p. 59.

1937 c Discoveries of Brigham Young University Archaeological Party Regarding Ancient Fremont Peoples. Science Service, (Science Newsletter), July 13, 1937.

Roberts, F. H. H., Jr.

1935 A Folsom Complex. Preliminary Report on Investigations at the Lindenmeier Site in Northern Colorado. Smithsonian Miscellaneous Collections, Vol. 94, No. 4. Washington.

1936 Additional Information on the Folsom Complex: Report on the Second Season's Investigations at the Lindenmeier Site in Northern Colorado. Smithsonian Institution Miscellaneous Collections, Vol. 95, No. 10. Washington.

Rudy, Jack R.

1953 Archeological Survey of Western Utah. University of Utah Anthropological Papers, No. 12, Salt Lake City.

Schaafsma, Polly

1971 The Rock Art of Utah. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, Vol. 65. Cambridge.

Sharrock, Floyd W.

1966a Prehistoric Occupation Patterns in Southwest Wyoming and Cultural Relationships with the Great Basin and Plains Culture Areas. University of Utah Anthropological Papers, No. 77. Salt Lake City.

1966b An Archaeological Survey of Canyonlands National Park. Miscellaneous Paper, No. 12, University of Utah Anthropological Papers, No. 83. Salt Lake City.

Sheets, Payson D.

1969 The Archaeology of the Ely Caves, Dinosaur National Monument. Clearing House for Federal Scientific and Technical Information, Department of Commerce. Springfield, Virginia.

Shields, Wayne F.

1967 1966 Excavations: Uinta Basin. University of Utah Anthropological Papers, No. 89, Miscellaneous Papers, No. 15, pp. 1-30. Salt Lake City.

Descriptive report of excavation of five Fremont sites: 3 ridge top sites believed to have been only briefly or intermittently occupied (Goodrich, Flattop Butte, and Felter Hill); Gilbert, a ridge top site with wetlaid masonry architecture and an abundance of charred corncobs--implying occupation of a more permanent nature; Whiterocks Village, the most extensive site, with one of the largest ceramic collections from the Basin. The latter was only partially excavated before crews were asked to leave by owners, so knowledge of this important site is scanty. Several types of structures found at the sites.
C-14 dates from 3 of the sites are as follows:
Gilbert Site: A.D. 670, 1630
Goodrich Site: A.D. 680, 710
Whiterocks Village: A.D. 820, 860
Discussion of C-14 dates for Uinta Basin useful
Appendix: Human Skeleton from Whiterocks

1968 "Prehistoric Cultural Resources of the Upper Colorado River Basin." In The Historic and Prehistoric Cultural Resources of the Upper Colorado River Region, by Wayne F. Shields, C. Gregory Crampton, Floyd A. O'Neil, and Gregory C. Thompson. A Special Report to the National Park Service (Contract #14-10-7:931-16) by the University of Utah, pp. 1-93. Salt Lake City.

Brief but good discussion of 1) inventory of prehistoric cultural resources with respect to the history of research in region, areas of concentrated occupations, chronological and cultural sequence of various sites (uses Stages to organize data) tribal distribution at time of contact. Most C-14 dates, if not all, are included. Includes section on recommendations--extensive and intensive survey plus excavation of specific cites. Good bibliography.

1970 "The Fremont Culture in the Uinta Basin." Paper presented at the Fremont Culture Symposium, 35th Annual Meeting of the Society for American Archeology. April 30-May 2, 1970. Mexico City, DF, Mexico.

Smiley, Terah L.

1951 A Summary of Tree Ring Dates from Some Southwestern Archaeological Sites. *University of Arizona Laboratory Bulletin of Tree-Ring Research*, No. 5. Tucson.

Steward, Julian H.

1933 a Archaeological Problems of the Northern Periphery of the Southwest. *Museum of Northern Arizona, Bulletin*, No. 5. Flagstaff.

1933 b Early Inhabitants of Western Utah, Part I-Mounds and House Types. *University of Utah Bulletin*, Vol. 23, No. 7, pp. 4-34. Salt Lake City.

Important record of finds made in the 1930's dealing with mounds and house types in following locations:
Willard: 4 mounds examined (3 previously excavated by Judd in 1915). Found "caches." Grantsville and Kanosh type houses found. Discusses "Willard Type."
Plain City: Numerous mounds noted mainly along Weber River, but none evidently excavated.
Grantsville: Believes 200 pit house sites once existed along N and S Willow Creeks for several miles. Important description and drawings of numerous houses, definition of Grantsville House Type.
Provo Mounds: Investigation of several mounds along old Provo road, 1 mi. from Utah Lake. Brief description of pit structures.
Kanosh: Good description, maps and drawings of mounds along Corn Creek. Excavation of several mounds with description of structures. Important work on 2-room surface adobe structures. Definition of Kanosh House.

Sevier Lake: Report on several sites around lake, some in dunes, several with pottery.
Filmore: brief mention
Uinta Basin: Excavated mounds on east bank of Uinta River, 7 mi. north of Fort Duchesne. Remains of apparently rectangular shallow pit dwellings. Rock wall house also found.

1936 Pueblo Material Culture in Western Utah. *University of New Mexico Bulletin*, 287, *Anthropological Series*, Vol. 1, No. 3. Albuquerque.

1940 Native cultures of the Intermontane (Great Basin) area. *In* "Essays in Historical Anthropology." *Smithsonian Miscellaneous Collections*, Vol. 100, pp. 445-502. Washington.

Stewart, Omer C.

1958 Shoshoni History and Social Organization. *33rd International Congress of Americanists*, pp. 134-142. San Jose, Costa Rica.

Stirland, Robert D.
1947 Report on Reconnaissance in Dinosaur National Monument, Jones Hole Area. Ms. on file, Dinosaur National Monument Headquarters.

Strong, William Duncan
1935 An Introduction to Nebraska Archeology. Smithsonian Miscellaneous Collections, Vol. 92, No. 10. Washington.

Suhm, Dee Ann
1959 A Report of Investigations at Two Archeological Sites in the Flaming Gorge Reservoir Area, Daggett County, Utah. MS on file, Department of Anthropology, University of Utah. Salt Lake City.

Swanson, Earl H., Jr. and Alan Lyle Bryan
1964 Birch Creek Papers No. 1: An Archaeological Reconnaissance in the Birch Creek Valley of Eastern Idaho. Occasional Papers of the Idaho State University Museum, No. 13. Pocatello.

Swanson, Earl H., Jr., B. Robert Butler and Robson Bonnichsen
1964 Birch Creek Papers No. 2: Natural and Cultural Stratigraphy in the Birch Creek Valley of Eastern Idaho. Occasional Papers of the Idaho State University Museum, No. 14. Pocatello.

Swanson, Earl H., Jr. and Paul G. Sneed
1966 Birch Creek Papers No. 3: The Archaeology of the Shoup Rockshelters in East Central Idaho. Occasional Papers of the Idaho State University Museum, No. 17. Picatello.

Thorne, Leo C.
1966 The Last Arrow: The Disappearance of the Pit House Dwellers from Northeastern Utah. Privately printed. Vernal, Utah.

"The story of a primitive people in the Vernal, Utah area some three thousand years ago. The Pit House People, a peace-loving farmer folk, were exterminated by a nomadic Egyptian type of man."

Wedel, Waldo R., Wilfred M. Husted and John H. Moss
1968 Mummy Cave: Prehistoric Record from Rocky Mountains of Wyoming. Science, Vol. 160, pp. 184-186. Washington.

Wenger, Gilbert R.
1955 A Brief Summary of the Archeology of Southern Blue Mountain and Douglas Creek in Northwestern Colorado. In A Reappraisal of the Fremont Culture, by H. M. Wormington. Proceedings of the Denver Museum of Natural History, No. 1, pp. 140-142. Denver.

Brief report of an archeological survey done in Colorado, immediately east of the Utah state line. Numerous masonry granaries were recorded, concentrated on the southern slopes of Blue Mountain (description indicates that they are just like those described for Range, Florence and Chandler Creeks.) Pottery recovered at only ten sites--Ute or Uinta Gray, one Tusayan Corrugated. Larger more detailed report of surveys, MS, MA thesis by Wenger.

Wenger, Gilbert R.
1956 An Archaeological Survey of Southern Blue Mountain and Douglas Creek in Northeastern Colorado. Masters thesis, University of Denver. Denver.

Winter, Joseph C. and Henry G. Wylie
1974 Paleoecology and Diet at Clyde's Cavern. American Antiquity, Vol. 39, No. 2, Part 1, pp. 303-315. Washington.

Wormington, H. Marie
1955 A Reappraisal of the Fremont Culture with a Summary of the Archeology of the Northern Periphery. Proceedings of the Denver Museum of Natural History, No. 1. Denver.

1957 Ancient Man in North America. Denver Museum of Natural History Popular Series, No. 4. Denver.

Wormington, H. Marie and Robert H. Lister
1956 Archaeological Investigations of the Uncompahgre Plateau. Proceedings of the Denver Museum of Natural History, No. 2. Denver.

B. PALEONTOLOGICAL SURVEY REPORT

THE FOLLOWING SITE LOCATION DATA AND MAPS ARE TO BE OMITTED FROM PUBLIC COPIES OF THE U-A AND U-B ANTIQUITIES REPORTS TO PREVENT UNAUTHORIZED COLLECTING AND VANDALISM

"Paleontological Survey Report of Federal Oil Shale Lease Tracts U-a and U-b, Uintah County, Utah."

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Note: Reference has been made in QR4 as to location and availability of the site location data.

PALEONTOLOGICAL SURVEY REPORT OF FEDERAL OIL SHALE LEASE TRACTS U-a AND U-b, UINTAH COUNTY, UTAH

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INTRODUCTION

Synopsis

The purpose of the paleontological survey was to determine the kinds, locations, accessibility and abundances of fossils in and adjacent to Tracts U-a and U-b, Uintah County, Utah (see Locality Map, Appendix C). This was done in order to assess the scientific value of the fossils. Both beneficial and adverse potential impacts were identified. In addition, impact areas associated with the Baseline Monitoring Sites (BMS) and auxillary facilities were inspected prior to construction in order to identify possible adverse impacts.

Most sections comprising Tracts U-a and U-b were found to contain at least some fossils. Significant fossil sites are plotted on a topographic map (Appendix G), along with their descriptions (Appendix D). Identified fossils include leaf imprints and compressions, petrified wood, insects in larval and adult forms, fish scales and bones, turtle shells, crocodile teeth and bones, and mammal teeth and bones. Leaf material, some petrified wood, insects, and fish were found in the Green River Formation, and additional petrified wood, turtle, crocodile, and mammal specimens were found in the Uintah Formation. With the exception of algae, plant fossils consist of angiosperms (flowering plants), including such types as reeds, laurel, willow, poplar, and sycamore. The fossil insects consist mostly of flies, the bulk of which are in larval form. All identified fish remains are of a fresh-water gar pike. The identified mammal specimens belong to several types of brontothere (an extinct relative of the rhinoceros). The flora (plant

assemblage), and fauna (animal assemblage) indicate warm humid climatic conditions when they inhabited the region.

The presence of some of these fossils is considered scientifically important. As just indicated, they enable interpretations to be made of past climatological conditions. In addition important information can be obtained on environment, chronology (time of past events), and past distributions of the organisms involved. In some instances it is possible to determine the place of origin for types of plants and animals. The most significant fossils found during the survey were the insects and brontotheres. The former are significant because abundant, well-preserved specimens are relatively rare in the fossil record and the latter because of their usefulness in dating and for evolutionary studies.

Construction of existing Baseline Monitoring Sites and access roads has not disturbed significant fossil deposits. However, a few of these monitoring sites are in close proximity to fossil localities (see Appendix F).

It is recommended that the sections containing abundant insects or remains of brontotheres not be disturbed. If it becomes imperative to do some excavating in them, then sufficient time should first be given to recover significant fossil specimens. The possibility of additional important fossils being uncovered during future excavations in the entire area makes it necessary that a qualified paleontologist do periodic inspecting. Also, the impact of an increasing population in the region necessitates continual checking of fossil locations, especially easily accessible ones, for vandalism and unauthorized collecting (as defined by Federal Antiquities Laws and Regulations).

Identification of Responsible Parties

VTN Colorado, Inc. of Denver, Colorado, is the consultant for environmental baseline monitoring and collection studies on Tracts U-a and U-b, Uintah County, Utah. These federal oil shale tracts are being leased by the White River Shale Project. Dr. Wade E. Miller, of Brigham Young University (resumé in Appendix), is the principal investigator of the paleontological survey. He has been assisted by graduate students James Barton, Steven Barker, and Helen Klopp, and by one senior, Kathryn Pearson.

Tracts U-a and U-b are located about three miles south of the mining town of Bonanza, Utah. Their positions can be determined from the vicinity (Appendix A) and the topographic map (Appendix G). Permission to do paleontological work on these federal tracts was granted by the Office of Archaeology and Historic Preservation under the Department of the Interior. The permit number is 75-UT-014. A copy of this permit and the accompanying cover letter can also be found in Appendix A. Tracts U-a and U-b include the following areas:

Tract U-a

T10S, R24E (Salt Lake Meridian)

Sec. 19, E 1/2;
Sec. 20, all;
Sec. 21, all;
Sec. 22, all;
Sec. 27, all;
Sec. 28, all;
Sec. 29, all;
Sec. 30, E 1/2;
Sec. 33, N 1/2;
Sec. 34, N 1/2.

Tract U-b

T10S, R24E (Salt Lake Meridian)

Sec. 12, S 1/2, S 1/2, N 1/2;
Sec. 13, all;
Sec. 14, all;
Sec. 23, all;
Sec. 24, all;
Sec. 25, W 1/2, W 1/2;
Sec. 26, all.

T10S, R25E (Salt Lake Meridian)

Sec. 18, all;
Sec. 19, all.

Disposition of Collected Data and Specimens

Field notes and locality maps pertaining to the paleontological survey of Tracts U-a, U-b, and vicinity are on file in the Brigham Young University Museum. The fossil specimens which were collected during this survey have been curated and are stored in specimen cabinets as part of the museum collection. Additional information relating to collected data and specimens can be found in this report in the section titled, "Description of Methodological Considerations."

THEORETICAL CONSIDERATIONS

Research Objectives and Goals of Paleontology

A major goal of paleontology is to determine as many phylogenies (lineages) of various life forms as possible and the interrelationships of ancient organisms. Another goal is to determine how each organism functioned in life, insofar as the fossil evidence will allow, and how it affected its environment. This knowledge not only indicates the vast array of life forms in the past, most of which are now extinct, but helps modern biologists better understand living plants and animals. Many existing morphologic structures on present-day life can be properly understood only by a knowledge of prehistoric life forms (e.g., the wing structure of birds from their reptilian ancestors, the one-toed and two-toed condition of most living ungulates from five-toed ancestors, the origin of amphibians from fish ancestors, etc.). Fossils constitute the only documented record for the concept of evolution.

It is assumed that life first began on earth at least three and one-half billion years ago. The first evidence of life consists of very simple bacterial, fungal and algal plant types from South Africa. These have been dated slightly in excess of three billion years. From these simple beginnings life is thought to have evolved into the complex array that now inhabits the earth. The evolution of life forms has been very slow, however, and has usually followed an orderly development, with less adaptable organisms becoming extinct while more adaptable ones survive. The principle of uniformitarianism (past events can usually be interpreted on the basis of present physical and biological laws) is constantly used in interpreting

succession of life. Although probably less than one percent of the organisms that ever lived became fossilized, enough have been preserved to gain a good general understanding of the history of life on earth.

Interpretation of past environmental conditions is largely made through a study of fossils. Fossils are extremely important in dating past events on earth; more so generally than any other method, including radiometric dating (see Eicher, 1968; Stirton, 1959 and others). Using fossils for correlating strata has also been an important tool in locating economic deposits. Fossils have also offered much information regarding the very important concept of Continental Drift. Even the presence of valuable hydrocarbons in the current area of study is the result of past life.

In order to better understand all the uses put forth in the preceding paragraph, it is necessary to have as many fossils to study as possible. They are needed from as many different stratigraphic levels (in some cases just inches apart) and localities as possible. It is thought by many people that one fossil of a kind should be enough. In reality there is rarely ever enough. Important studies in variabilities of organisms necessitates as many fossil specimens as can be obtained. This is especially true of the vertebrates which are generally more rare as fossils than plants or invertebrates.

Environmental Planning Study Considerations

Any environmental planning should take fossils into consideration. They constitute an important national resource which is not renewable. Unfortunately, the significance of fossils has not been considered in most past projects, and the fossils have been lost to science. One of many

examples is the building of the Glen Canyon Dam and the formation of Lake Powell. A number of important fossil sites which had not been adequately collected are now inaccessible. It is extremely important that fossils, like archeological artifacts, be considered before major construction projects commence. In most instances, fossils, where their presence impedes construction, can be collected so they will not prevent development of lands.

DESCRIPTION OF METHODOLOGICAL CONSIDERATIONS

General Statement

The paleontological survey was divided into four steps or phases which were in part conducted simultaneously. How many of these phases that were carried on at one time was dependent on weather conditions and the number of people participating. The four phases were literature search and map study, field survey, identification of specimens and report writing.

Persons assisting in the paleontological survey are three selected graduate students and one senior majoring in paleontology. All have had field course work as well as academic studies in paleontology and have shown proficiency. The number of students selected to assist was dependent on the area to be surveyed and time limits involved.

On one occasion it was necessary to confer with a specialist in entomology in order to determine the scientific value of insect fossils. Dr. Stephen Wood, the entomologist consulted, prepared an evaluation which is contained in this report (Appendix H).

Literature Search and Map Study

It was necessary to conduct a preliminary literature search before commencing field work. Information thus gained alerted the field party to some of the previous fossil finds that had been made in the survey area. Data gained from prior study of topographic and geologic maps was also of value in the field work. This data helped in determining which areas were likely to be fossiliferous and those which were not. A significant amount of time in the actual field survey was saved by this knowledge.

Many articles have been written about the geology and paleontology, especially the former, of the Uinta Basin. Those that contained paleontological data were consulted but only the articles which had significant information are included in the bibliography (a number of the articles only restated the paleontological work of others). A geologic map of Utah (Stokes et al., 1961-1962) was used in conjunction with geologic maps and stratigraphic columns contained in several articles which were consulted and which appear in the bibliography of this report.

Field Study

A preliminary inspection of the area to be surveyed was made by Dr. Wade Miller at the beginning of the literature search and map study. This was done to determine access roads and what type of field equipment would be necessary.

The field party, with Dr. Miller as supervisor, began the actual survey as soon as the preliminary literature search and map study was made. When Dr. Miller was not able to be in the field, a qualified assistant was in charge.

The manner in which the area was surveyed depended somewhat on the special conditions of the project. The Baseline Monitoring Sites and auxillary facilities, including new or regraded access roads, were checked for fossils first. A systematic coverage of the entire area was made, section by section.

The field party set up camp in the study area (Section 2, T10S, R24E). Permission was first obtained from the owner, Mr. Case of Vernal, Utah. The surveyed areas were reached by field vehicle or, when that was not

possible, on foot. Generally, the work week was Monday through Friday or Saturday. Each day's work began shortly after sun-up and continued until shortly before sun-down.

During the survey extensive notes were taken by each party member concerning the area covered (a separate copy of the procedures for field notes is included as Appendix K). Sites from which fossils were found have been plotted as accurately as possible on a topographic map and marked with a field number (see Appendix G). Relevant data about the fossils have been recorded in field notes. Polaroid pictures were taken of significant sites (distant and close up) to allow quick identification of the site at a later date.

Recovered fossils were given a field identification, wrapped and numbered (the method of specimen identification is included in Appendix J). A more accurate identification was later made in the laboratory. No extensive collecting was done during the survey, only representative samples were taken.

EXISTING RESOURCES

General Geology and Paleontology of the Uinta Basin

The Uinta Basin is a topographic and a structural basin, both of which roughly coincide, according to most interpretations; however, the areal extent of this basin has been defined differently by some workers, even to the present day. Two differing interpretations are included as maps (see Appendix B). Boundaries of the Uinta Basin are most commonly recognized as the Uinta Mountains to the north, Wasatch Mountains to the west, Roan and Book Cliffs to the south, Uncompahgre Uplift (Plateau) to the southeast, and the Douglas Creek Arch to the east. While these bounding structures contain rocks which range in age from Precambrian through Early Tertiray, the Uinta Basin itself is largely covered with Tertiary strata, mostly of Eocene age. Quaternary deposits, mostly sands and gravels, are confined to stream courses, and to unconsolidated deposits at the base of uplifted areas. The exposed rocks by older Tertiary deposits, and rocks of Mesozoic age.

Formation of the Uinta Basin first took place in Early Tertiary time during the closing stages of the Laramide orogeny. This can be determined by the deformation of Paleocene and early Eocene beds in the surrounding region. Soon after the formation, the basin began filling with water to produce Eocene Lake Uinta. It was in this lake that the Green River Formation sediments were in deposited in large measure. As the lake began to wane, fluviatile (sediments deposited by a stream within the stream channel) and flood plain deposits covered the older lake sediments; these deposits constitute the Uinta Formation (Bradley, 1931). Underlying earlier Tertiary

and Mesozoic rocks are not generally seen in the basin, but are exposed in the uplifted bordering structures such as the Uinta and Wasatch Mountains. Their presence beneath the Uinta Basin can be inferred by the regional stratigraphy and has been verified by deep drilling operations. Much of the above information was obtained through guidebooks produced by the Intermountain Association of Petroleum Geologists (1957, 1964) and by personal observations.

One of the most famous Mesozoic formations in the region is the Morrison. It is well exposed at the southern base of the Uinta Mountains, especially along their eastern extent, and probably underlies the Uinta Basin. Most of the dinosaurs from North America have been recovered from the Jurassic Morrison Formation. Fossil dinosaurs from this formation can be seen at Dinosaur National Monument.

Abundant Cretaceous rocks overlie the Morrison Formation. These are extensively exposed in surrounding uplifted structures and also underlie the Basin. During the Cretaceous time the sea invaded much of the eastern part of Utah, as determined by fossils of this period. These fossils are extremely abundant in some of the Cretaceous strata and include a variety of molluscs, trace fossils, foraminifera, bony fish, sharks and marine reptiles. Some of the Cretaceous rocks represent terrestrial conditions. They have yielded fossils of land plants, some invertebrates and a variety of reptiles including dinosaurs. Even fossilized dinosaur egg shells have been found.

The earliest Tertiary rocks that underlie the exposed Eocene deposits in the Uinta Basin also contain fossils where they outcrop in surrounding structures. They represent nonmarine conditions. Recovered fossils include

various plants, several types of invertebrates (especially molluscs and ostracodes), fish, aquatic reptiles (turtles, champsosaurs and crocodiles), terrestrial reptiles (mostly tortoises and lizards), birds and mammals.

Most of the exposed strata in the Uinta Basin consists of alluvial (stream related) and lacustrine (lake) deposits. The primary formations involved in ascending age are the Green River, the Uinta and Duchesne River. These formations have yielded abundant fossils in many areas within the Uinta Basin. Excellent specimens representing plants, invertebrates and vertebrates have been collected over the past 100 years. Plant fossils are mostly pollen, petrified wood and leaf imprints of angiosperms (flowering plants) but significant specimens of lower plant types, including algae, have been recovered. Invertebrates are mostly represented by freshwater molluscs, ostracodes and insects. The vertebrate fossils are especially numerous and varied. Included are freshwater fish, reptiles (especially turtles, tortoises and crocodiles), birds and a host of mammals. The types of mammals found in the Uinta Basin are all extinct but some have left living descendents belonging to the same taxonomic family. Identified fossil mammals from the basin include marsupials, insectivores, primates, tillodonts, taeniodonts, rabbits, rodents, credonts, carnivores (one type was larger than the African lion), condylarths, Uintatheres, a wide variety of bronototheres (=titanotheres), ancestral horses (lamb-sized animals), rhinoceroses, oreodonts, ancestral camels and other artiodactyls.

Several types of Eocene mammals are best known in the Uinta Basin. Camels for example occur earlier here than in any other place, indicating they originated in the Uinta Basin area (Scott, 1898, and others). The mammalian deposits of the Uinta Basin are considered classic for the latter

half of the Eocene in North America. Their importance is recognized by paleontologists all over the world.

Previous Investigations

Over 100 years ago F. V. Hayden, a chief geologist for the first United States Geological Survey, studied the Uinta Mountains and Basin. Although he was not primarily a paleontologist, he understood the value of fossils and had more important ones shipped to the leading paleontologists who, incidentally, did much of the early detailed geology. Some work on fossil plants was done in the late 1800's, but perhaps the most significant studies on them were made by Knowlton in 1923 and MacGinitie in 1969. Fossil insects of the area were also studied in the latter part of the last century, mostly by Scudder. Although some research has been done on these insects in relatively recent time (Carpenter, 1955) much more remains to be done. Most of the important fossils from the Uinta Basin are vertebrates. These were first studied in the 1880's by the most eminent vertebrate paleontologists of North America, if not the world. Included were O. C. Marsh, E. D. Cope, W. B. Scott and H. F. Osborn. According to reports, these men came by rail and wagon. Another generation of paleontologists worked the area in the early 1900's. Since that time to the present only a few paleontologists have worked in the Uinta Basin.

My own work in various locations of the Uinta Basin shows that much more work still needs to be done. Early workers commonly were not careful in recording exact topographic and stratigraphic positions of the recovered fossils. Therefore, more recovery of fossils is needed to gain this information. This is necessary for precise chronologic relationships of the enclosing strata as well as the animals themselves. Also, more complete specimens are needed for a number of the animal types so that they can be better understood. For example uintatheres are known only from Wyoming, Colorado, Utah and Mongolia. Only a few specimens are known from Utah and these are from the Uinta Basin.

Discussion of Formations Occurring in Northeast Uinta Basin

Quaternary Lacustrine and Alluvial Deposits:

Sediments of Pleistocene or Recent age in the Uinta Basin are mostly lacustrine or alluvial, but some talus deposits exist at the base of escarpments. The lacustrine and alluvial materials consist of lake sediments. floodplain deposits and channel sands and gravels (Stokes *et al.*, 1961). Although not many Pleistocene (Ice Age) fossils have been reported from these deposits in Utah, they probably occur in significant numbers as based on finds from surrounding states. Until recently they have not been seriously investigated in Utah, however, some important finds have been made and reported (e.g., Bissell, 1968; Hansen, 1928; Miller, 1973; Stokes, 1966 and others). A partial mammoth (not yet reported in the literature) was discovered last fall less than one foot beneath the land surface in lake sediments near Sandy, Utah. This could happen in Pleistocene lacustrine and alluvial deposits anywhere in the state.

Tertiary Uinta Formation:

The Uinta Formation represents the youngest strata in the study area (the Quaternary deposits here are not extensive enough to be conventionally considered as strata). Aside from the younger Duchesne River Formation which is present in the Basin to the west of the study area and is also Eocene in age, there are no Tertiary strata of more recent age. These were either not deposited or else were previously completely eroded away.

Evidently Comstock first used the term "Uinta" in 1875 for some of the exposed Eocene beds in the Uinta Basin. King and Emmons clarified this name later in the same year. However, some confusion arose thereafter, as Powell used the term "Uinta Group" to represent sandstones he thought were

of Devonian age in the Uinta Mountains. Although the name Uinta Group or Formation has had a rather complex nomenclatural history, it generally applied to late Eocene strata in the Uinta Basin. Peterson (in Osborn, 1895, p. 72-74) divided the Uinta Formation into three horizons or members (A, B and C) on the basis of fossil vertebrates. These members have been used to the present day by many investigators as they also have lithostratigraphic validity. There is still, however, some confusion as to their boundaries, which will take further study to resolve.

As indicated previously, many of the earlier paleontologists were not specific in their designation of fossil localities. Many of them simply listed the Uinta Basin generally as the site of fossil recovery. Some of their work may have been on what is now known as Tracts U-a and U-b or close to them, but exactly where will never be ascertained. Riggs (1912), however, was fairly specific and reported many important vertebrate finds, especially brontotheres, from the Uinta A (and possibly lower B) in the cliffs along the north side of the White River below the mouth of Evacuation Creek. The present paleontological survey has relocated some, but not all, of his fossil sites.

Many vertebrates new to science, especially mammals, were discovered in the Uinta Formation of the Uinta Basin; and as can best be determined, mostly from the eastern part of the basin. The types of animals discovered are listed on page 13 of this final report. Some of the articles reporting these vertebrates are Black, 1968 and 1970; Black and Dawson, 1966; Burke, 1934 and 1935; Dawson 1968; Douglass, 1909 and 1914; Gazin, 1955 and 1968; Gilmore, 1946; Gregory, 1912; Kay, 1957; Matthew, 1921; Osborn and Scott, 1890a and 1890b; Peterson, 1918 and 1919; Riggs, 1912; Scott, 1895, 1898 and 1899; Wortmann, 1898.

Prior to my field work for the present survey I investigated the paleontology of the Uinta Formation in the eastern part of the Uinta Basin. This work has shown that many significant fossils still exist in much of the area. These fossils must be collected by professionals representing recognized scientific institutions and should be properly preserved, described, and stored.

Tertiary Green River Formation:

The oldest and most extensively exposed strata in the study area belong to the Eocene Green River Formation, which conformably underlies the Uinta Formation. Although not exposed in the study area, the Wasatch, or Colton, Formation underlies the Green River Formation.

In 1869 Hayden named these deposits the Green River shales, which later became the Green River Formation. The lithology of this formation was first described in detail by Bradley (1931) who designated four members; Douglas Creek, Garden Gulch, Parachute Creek and Evacuation Creek. Because these members are not always clearly defined wherever the Green River Formation exists, later workers in some cases have not always used them or have designated others (e.g., Dane, 1954; Hintze, 1973; Picard *et al.*, 1973; Winchester, 1918 and others). This formation has long been known for its richness in hydrocarbons. These hydrocarbons are the remains of the mostly microscopic life that lived in the Eocene lakes. In addition to this microscopic life, abundant megascopic fossils attest to the richness of life forms that lived in and adjacent to the ancient Green River Lakes. The Green River Formation is world renowned for the fossil fish it contains, largely from southwestern Wyoming; however, some important fish fossils have been taken

from the Uinta Basin. Although only scales of fish have thus far been discovered in Tracts U-a and U-b during the present survey, significant fish material could be contained here.

Most of the organic matter in the Green River Formation was derived from microorganisms, many of which have not yet been properly identified. Numerous macrofossils have also been reported. Included among the microfossils are various kinds of algae, pollen, spores, protozoans and ostracodes (Abbott, 1957; Bradley, 1931; Dane, 1954; Davis, 1916; Winchester, 1918 and others). Many references in the literature on the Green River Formation have also been made concerning macrofossils. These include varieties of plant leaves and wood (mostly of angiosperms), fresh-water molluscs, varied adult and larval insect remains, fish, turtles, crocodile teeth and bones, various birds, and mammals such as insectivores, rodents, primates, condylarths and brontotheres (Baer, 1969; Burke, 1935; Carpenter, 1955; Cashion, 1967; Curry, 1957; Gazin, 1955; MacGinitie, 1969; Moussa, 1968; Parker, 1970; Picard, 1955; Scudder, 1890 and others). These references pertain to the Uinta Basin or areas adjacent to it. Because of the vagueness of some locality descriptions, it was not possible to know what specific areas in the basin were included; however, some were in and by Tracts U-a and U-b.

The Green River Formation is especially important because its fine-grained sediments and quiet-water deposition have enabled fine details of fossils, usually lost, to be preserved. Veination in leaves, insect wings, and even insect tracts can be seen clearly. Scientifically, this is very important. Bird tracks are abundant in some western parts of the Uinta Basin. My own previous work has turned up the imprint of a feather, a rare type of fossil.

Locations, Concentrations and Types of Fossils

Fossils were discovered in most of the sections surveyed. Their locations can be found by consulting the U. S. G. S. Topographic Map (Appendices F and C). Site numbers, site descriptions, identified taxa and abundances are located in Appendix D. Concentration of fossils varied from dense to sparse. The most significant were insects (sections 5, 8, 9 and 28, T10S, R25E; section 36, T10S, R24E; sections 4, 5 and 6, T11S, R25E) and brontotheres (sections 2, 3 and 10, T10S, R24E; sections 3 and 4, T11S, R24E).

The hydrocarbons in the study area were not analyzed for their microscopic fossil content; however, past studies have been made on them (see accompanying section, "Previous Investigations of Paleontological Resources"). This also applies to ostracodes which are microscopic, bivalved arthropods (the animal phylum that includes insects, crabs, etc.) that have been reported in the literature from the Green River Formation in locations near Tracts U-a and U-b. Various algal structures are present in the limy deposits of the Green River Formation, but they were not considered sufficiently important to spend time in microscopic analysis. The more easily identified plant fossils consisted of leaves of angiosperms (flowering plants) such as laurel (*Umbellularia*), poplar (*Populus*), willow (*Salix*), and sycamore (*Platanus*). Most leaves occur as carbonized compressions but a few leaf imprints are also present. Fossilized wood of angiosperms is fairly common in some locations within the study area; however, generic identifications are not usually possible based on this type of fossil.

Four orders of insects--Diptera (true flies), Odonata (dragonflies and damselflies), Coleoptera (beetles), and Hemiptera (true bugs)--have been identified in and adjacent to Tracts U-a and U-b. The first order is much

better represented than the other three. Six families of Diptera have been recognized in the sample collections made. These include Bibionidae, Syraphidae, Muscidae, Stratiomyidae, Oestridae, and Tipulidae. In the first two named families, Bibionidae (march flies), and Syraphidae (flower flies), the fossils were not distinct enough for generic identification. The other families include the genera *Musca* (common fly), *Hypoderma* and *Lithohypoderma* (bot flies), *Lithophysa* (soldier fly), and *Tipula* (crane fly). The order Odonata is represented by one genus, *Sympetrum* (dragonfly). The order Coleoptera is represented by an unidentified beetle and the specimens representing the order Hemiptera are also not diagnostic enough for even a familial identification.

Fish remains were surprisingly scarce. Only scales and occasional fragmental bones were found. Although more than one type of fish is represented, only the gar pike, *Lepidosteus*, could be identified. Collected turtle specimens have not yet been sufficiently prepared to allow identification. Probably more than one genus is represented, though. Several teeth of a crocodilian evidently belong to the genus *Allognathosuchus*. Although some unidentified bone fragments may belong to a uintathere (a large mammal of the order Dinocerata), the only identified type of mammal is a brontothere (=titanothere). Apparently five genera of this animal (order, Perissodactyla) are present in sandstone exposures of the Uinta Formation, immediately north of the White River. Other mammals will probably be discovered in this area with continued searching. The identified genera of brontotheres (thunder beasts) include *Paleosyops*, *?Eotitanops*, *Telmatherium*, *Dolichorhinus*, and *Metarhinus*.

The type of preservation is varied among these fossils. As previously mentioned, the leaves occurred either as imprints or as carbonized compressions (the latter were much more common in the study area). The fossilized wood fragments were petrified (replaced with silica mostly). Most of the adult insects were preserved as imprints, while the far more abundant larval forms occurred as carbonized compressions or imprints. The fish scales were somewhat leached, but otherwise contained their original materials. The fragmental bones were variably replaced with mineral matter as were the shell fragment of the turtles and the bones of the mammals. Both the crocodilian and brontothere teeth were stained dark brown but otherwise probably contained the original enamel and dentine.

Significance of Fossils

All fossils have significance. However, the degree can range from slight to great. Plant fossils are only useful as geologic time indicators in a general way. Their significance as past climatic indicators is commonly very important, though. This holds true for plant fossils from the Uinta Basin, especially in the Green River Formation. Invertebrate fossils are usually better time indicators than plants and are also useful in interpreting paleoenvironments. Ostracodes, and to a lesser degree, molluscs, have been used in geologic correlations in and around the Uinta Basin as well as elsewhere. The vertebrates, especially the mammals, are very important as time indicators. Although most of these fossils from the Uinta Basin are from the Uinta and Duchesne River Formations, some significant finds have been made in the Green River Formation. Vertebrate fossils are also useful in determining past

climatic and environmental conditions for a given time and place. They have been important in the determination of the interpretation of the Green River Formation as a series of lake beds and the Uinta Formation as primarily stream deposits.

Aside from radiometric dating, which is very limited in sedimentary rocks, fossil mammals* permit the greatest dating precisions in Cenozoic age strata. A set of mammal ages has been worked out for the Cenozoic of North America (similar sets based on different mammals has or is being worked out for other continents). These are subdivisions of time which are chronologically more refined than those based on other means. The North American Mammal Ages for the latter half of the Eocene are based on mammalian fossils from the Uinta Basin.

The first camels in the world are known from the Uinta Basin. Much of what is known of bronotheres also comes from this area. A number of other mammal types are also best known from here. Therefore, the fossils from the Uinta Basin are quite significant for many reasons.

The fossils that have been identified from Tracts U-a and U-b clearly show environmental changes that occurred from the deposition of the Green River Formation to that of the Uinta Formation. High concentrations of insect larvae and numerous reed imprints are highly suggestive of lake deposits that are typical of the first-named formation. The overlying Uinta Formation includes stream-dwelling brontotheres, which reflect an environmental change from the underlying lake deposits. Lithology also bears this out.

In general, fossil insects have not been studied nearly as extensively as other groups in paleontology. Information concerning them is

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*a system jointly employing fossil mammals and magnetic reversals in sedimentary rocks in now being developed for later Cenozoic strata.

potentially very important because they can offer much in studies of paleoecology, paleoclimatology, and evolutionary studies. Dr. Stephen Wood, of Brigham Young University, a nationally recognized entomologist, assessed the fossil insects on Tracts U-a and U-b. A copy of his evaluation is included as Appendix H. Most of the known good fossil plant localities in the Green River Formation lie outside the study area. One of these is about three miles to the north, southeast of Bonanza. The potential for an excellent deposit of fossil plants in Tracts U-a and U-b does exist, however. The presence of several types of brontotheres is considered very important. Their abundance and good state of preservation make them scientifically valuable. They range through a few hundred feet of strata, so evolutionary changes can possibly be detected. Previous work on them in this area was incomplete, and additional studies are needed. Other mammals are probably present in the Uinta Formation here also.

The present paleontological survey has provided additional fossil specimens of scientific value that otherwise might not have been found for some time. Future collecting of the important fossil sites will provide valuable specimens to the scientific community. A capability exists here to provide several research problems for students in different disciplines of paleontology. A possibility exists that the insect and brontothere fossils might be significant enough for inclusion in an historic inventory such as a national or state landmark. Additional field work would be necessary to determine this, though.

IMPACTS

None of the existing monitoring stations, new roads, or newly graded roads in or adjacent to Tracts U-a and U-b have caused damage to significant fossil sites. Important fossil deposits mentioned in the preceding section exist in this area, though, and excavation or construction should be avoided at critical locations.

In general, development of the tracts will not cause direct damage to significant fossil sites, but another threat to discovered fossils does exist. Once a discovery is made, word of this find usually spreads and many people are soon aware of it. The danger exists, then, in unauthorized persons collecting these fossils on their own or vandalizing them. This threat greatly increases if many more people move into the region with oil shale development. Future roads, cable lines and pipelines, etc., also add to the threat of fossil destruction.

As previously indicated, the Green River Formation is noted for its abundant fossils. There is always a good possibility that they will be encountered when excavations are made in the formation. A qualified paleontologist should be present when any major excavation begins, to avoid disturbance of important fossils. Their discovery need not stop or even seriously delay excavation or building plans if a salvage operation can quickly be effected.

There have been beneficial impacts connected with the development of Tracts U-a and U-b. The palenotological survey necessary for this development enabled discoveries of fossil sites that otherwise might not have been found for some time.

MITIGATION MEASURES

Recommended Resource Conservation Methods

As development continues in and around Tracts U-a and U-b, periodic paleontological field checks should be performed by qualified personnel. This is necessary to determine what effect an increasing population in the area will have on existing fossils. These field checks should be made monthly or bimonthly for at least the next five years. Any excavations that threaten existing significant fossil sites as defined in this report (see Appendix D), or newly discovered ones, should be delayed until sufficient salvage of fossils can be made. Such delays should be as brief as possible.

Because of their present exposure, the brontothere fossils in the Uinta Formation immediately north of the White River should be collected as soon as possible. Their general presence is now known to people working on the existing projects and even to townspeople in Vernal. It is only a matter of time before people discover the exact fossil sites. Although most of the brontothere specimens are enclosed in hardened sandstone, past experience has shown that individuals will smash a jaw or skull just to obtain fragments. These fossils are too valuable scientifically to allow this to happen. No agency at the present time has accepted the responsibility to finance their proper removal.

It is recommended that the Bureau of Land Management provide an educational program to enlighten the public on the need to preserve

fossils and their scientific value. This could be done by employing paleontologists on their staff (as they have archaeologists) and/or bringing in qualified consultants. A local paleontological exhibit, possibly in situ, would help in this educational program.

Applicable Laws and Regulations

Historically, the Antiquities Act of 1906 was to provide for protection of fossils as well as archaeological and historical artifacts. However, the wording of this act was not considered sufficiently explicit or encompassing to adequately protect these concerns. Therefore, the Archaeological and Historical Preservation Act (P. L. 93-291) was enacted in 1974. As stated in sections 7A and 7B of this act, Federal agencies are authorized to utilize construction project funds for archaeological salvage. According to governmental interpretations (see Appendix I), fossils are to be included. Eligibility for funding is explained in section 6.

Dr. Wade E. Miller is currently involved as a committee member of the Society of Vertebrate Paleontology, a nationally recognized professional group, in trying to have the present act slightly modified to include fossils and paleontology in its direct wording. He is also involved in having the State of Utah legislation adequately protect fossils, along with other professional paleontologists.

There is no national or state registration for fossil sites as there is for archaeological ones. The United States National Museum, however, is requesting data concerning fossils from each institution that has them so that a central file can be made. The purpose of this file is to make

paleontological data more easily accessible to researchers and interested parties. Although this central data file has not been used to establish paleontological landmarks or monuments, it could be in the future. Separate legislative acts, usually instigated by paleontologists and interested parties, have been responsible for establishing present paleontological landmarks and monuments.

APPENDIX A

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

In Reply Refer To:
A9015-PI

APR 3 1975

Dr. Wade E. Miller
Department of Zoology
575 WIDB
Brigham Young University
Provo, Utah 84601

Dear Dr. Miller:

Enclosed is a Federal Antiquities Act permit which authorizes Brigham Young University to conduct paleontological investigations on certain lands owned and controlled by the Department of the Interior and administered by the Bureau of Land Management in the State of Utah (Federal Oil Shale Lease Tracts UA and UB). Please note this permit is numbered 75-UT-014, and should you have any reason to contact us regarding the permit, it will help if you refer to this number. Address all correspondence to:

Departmental Consulting Archeologist
Department of the Interior
Office of Archeology and Historic Preservation
Interagency Archeological Services Division
Washington, D.C. 20240

Also, we will appreciate your using this number for reference purposes when submitting the preliminary report at the completion of the fieldwork, or termination of the permit, as required by Item 9 of the permit.

Sincerely yours,

Rex L. Wilson
Departmental Consulting
Archeologist

Enclosure

JOHNNY HORIZON '76

Let's Clean Up America For Our 200th Birthday

10-71
1971)

UNITED STATES DEPARTMENT OF THE INTERIOR

Please use this number when referring to this permit.

NO. 75-UT-014

ANTIQUITIES ACT PERMIT

To Conduct Work Upon Lands Owned or Controlled by the United States Under the Act For The Preservation of American Antiquities

(Approved June 8, 1906 (34 Stat. 225, 16 U.S.C. 432, 433) and the Regulations Thereunder)

ERMIT ISSUED TO:
Brigham Young University/Provo, Utah

DATE:
April 2, 1975

AME, ADDRESS AND OFFICIAL STATUS OF PERSON:

a. In general charge:
b. In actual direct charge:

Dr. Wade E. Miller
Associate Professor, Department of Zoology
575 WIDB,
Brigham Young University
Provo, Utah 84601
and
Mr. Jim Barton - graduate student in vertebrate paleontology. (address same as above)

UNDER APPLICATION DATED:
March 10, 1975

UTHORIZES:
Paleontological Investigations

ON LANDS DESCRIBED AS FOLLOWS:

Department of the Interior lands administered by the Bureau of Land Management in the State of Utah (Federal Oil Shale Lease Tracts UA and UB).

OR PERIOD:
April 2, 1975 through April 1, 1976 (One year)

ATERIALS COLLECTED UNDER THIS PERMIT WILL BE DEPOSITED FOR PERMANENT PRESERVATION IN THE

Brigham Young University Museum
Provo, Utah

OR IN OTHER ACCREDITED INSTITUTIONS UNDER SUITABLE LOAN AGREEMENTS.

PECIAL CONDITIONS

This permit is subject to the provisions of the Act for the Preservation of American Antiquities approved June 8, 1906, and the interdepartmental regulations including 25 CFR 132, as to Indian lands, promulgated thereunder (copies attached), as well as the special conditions on the reverse of this form.

RELIMINARY REPORT

ithin approximately 6 weeks of the conclusion of field work, a preliminary report of work performed under this ermit, illustrated with representative photographs and listing new and significant collected materials should be urnished the Secretary, Smithsonian Institution, and 5 copy(s) thereof should be forwarded to this epartment.

ARTMENTAL CONSULTING ARCHEOLOGIST *(Signature)*

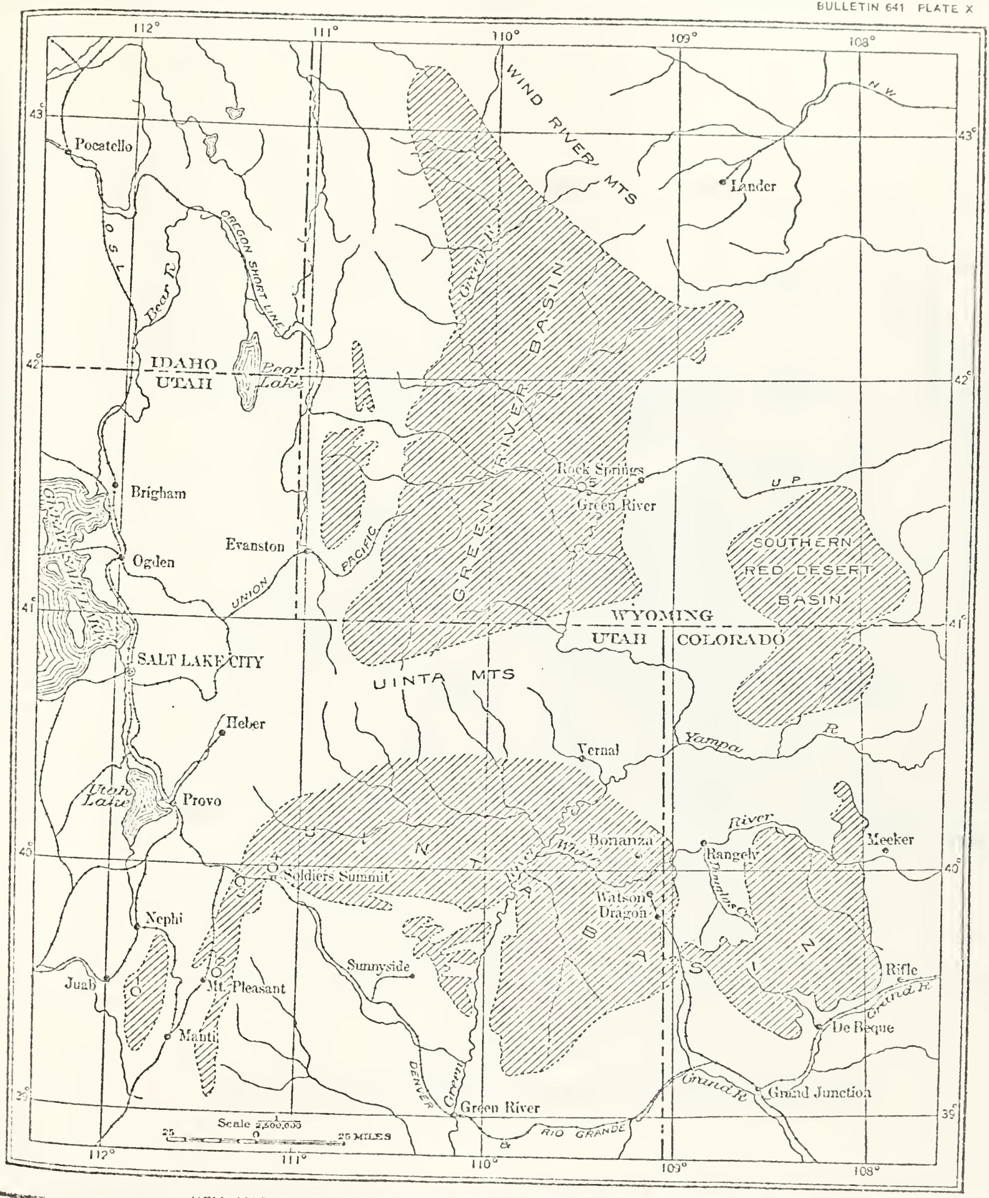
Rex L. Wilson

APPENDIX B

WINCHESTER, D. E., 1916 - Oil shale in Northwestern Colorado and adjacent areas

U. S. GEOLOGICAL SURVEY

BULLETIN 641 PLATE X


112°
111°
110°
109°
108°
43°
42°
41°
40°
39°
Pocatello
O. S. L.
Bear R.
OREGON SHORT LINE
IDAHO
UTAH
Bear Lake
WIND RIVER MTS
Lander
N. W.
Green R.
GREEN RIVER BASIN
Brigham
Great Salt Lake
Ogden
Evanston
UNION PACIFIC
Rock Springs
Green River
U. P.
SOUTHERN RED DESERT BASIN
WYOMING
UTAH
COLORADO
SALT LAKE CITY
UINTA MTS
Heber
Vernal
Yampa R.
Utah Lake
Provo
UINTA BASIN
Bonanza
White River
Rangely
Meeker
Soldiers Summit
Watson
Dragon
Douglas Cr.
Nephi
Juab
Mt. Pleasant
Manti
Sunnyside
Rifle
Grand R.
De Beque
Grand Junction
DENVER & RIO GRANDE
Green R.
Green River
Scale 1/2,500,000
25 0 25 MILES

CASHION, W. B. - 1967 GREEN RIVER FORMATION, UTAH AND COLORADO: U. S. GEOL. SURV. PROFESSIONAL PAPER 548

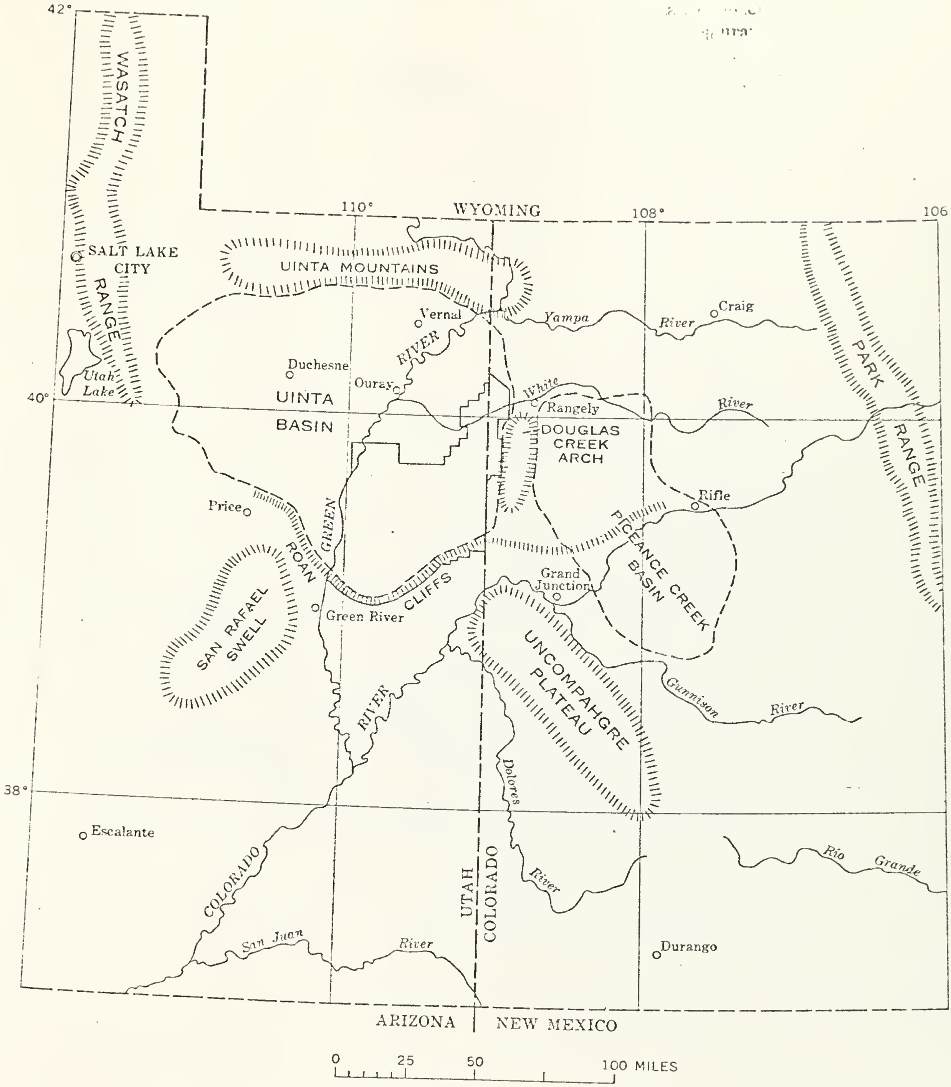
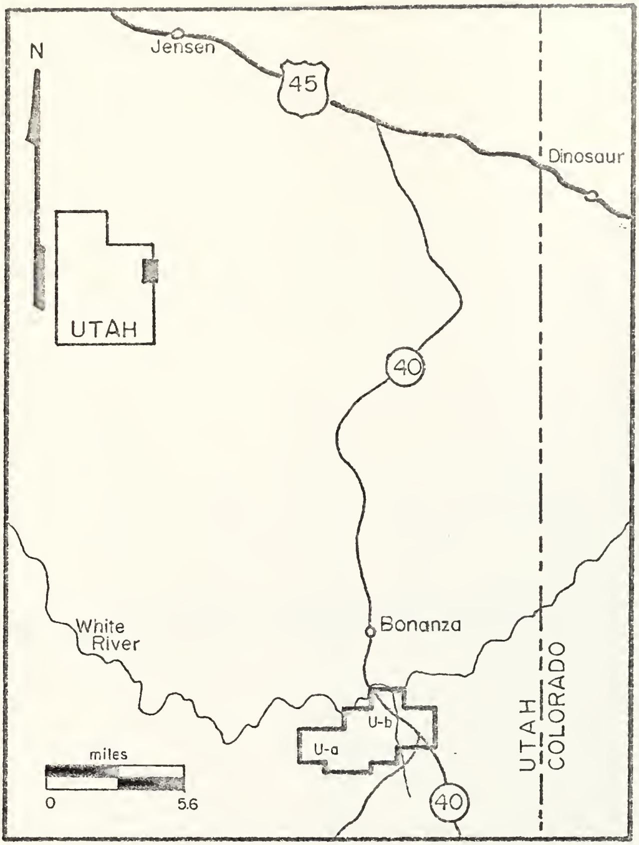

112°
42°
WASATCH
SALT LAKE CITY
RANGE
Utah Lake
40°
110°
WYOMING
108°
106°
UINTA MOUNTAINS
Vernal
Yampa
River
Craig
RIVER
Duchesne
Ouray
UINTA BASIN
White
Rangely
River
DOUGLAS CREEK ARCH
PARK RANGE
Rifle
Price
GREEN
ROAN
CLIFFS
PICEANCE CREEK BASIN
Grand Junction
SAN RAFAEL SWELL
Green River
UNCOMPAHGRE PLATEAU
Gunnison
River
RIVER
Dolores
38°
Escalante
Rio Grande
River
COLORADO
UTAH
COLORADO
San Juan
River
Durango
ARIZONA
NEW MEXICO
0
25
50
100 MILES

FIGURE 1.—Area of this report and some adjacent structural and physiographic features.

APPENDIX C


N
Jensen
45
Dinosaur
UTAH
40
White River
Bonanza
U-b
U-a
miles
0
5.6
40
UTAH
COLORADO

Locality Map of Tracts U-a and U-b, Uintah County, Utah

APPENDIX D

NOT FOR PUBLIC USE OR FOR PUBLIC DISTRIBUTION

APPENDIX D

Description of Fossil Sites from Tracts U-a, U-b, and Vicinity

Site #	Site Location	Site Description	Fossils Present	Significance
1	NE 1/4, Sec. 29, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Unidentifiable plant debris	Insignificant
2	NW 1/4, Sec. 14, T10S, R24E	Uinta Fm., massive sandstone	Unidentifiable plant debris	Insignificant
3	NW 1/4, Sec. 19, T10S, R24E	Green River Fm., thin-beeded shales	Fragmental plant material	Minor
4	NE 1/4, Sec. 23, T10S, R24E	Lowermost Uinta Fm., massive sandstone, and uppermost Green River Fm., thin-bedded shales	Unidentifiable plant debris	Insignificant
5	NE 1/4, Sec. 13, T10S, R24E	Green River Fm., thin-bedded shales	Fragmental plants & some complete leaves	Minor-Moderate
6	SW 1/4, Sec. 14, T10S, R24E	Lowermost Uinta Fm., massive sandstone, and uppermost Green River Fm., thin-bedded shales	Unidentifiable plant debris	Insignificant
7	WC, Sec. 20, T10S, R25E	Green River Fm., thin-bedded shales	Insects and leaves	Moderate
8	NW 1/4, Sec. 19, T10S, R25E	Green River Fm., thin-bedded shales	Fragmental plants & some complete leaves	Minor-Moderate
9	NE 1/4, Sec. 19, T10S, R25E	Green River Fm., thin-bedded shales	Fish scales & leaves	Moderate

Site #	Site Location	Site Description	Fossils Present	Significance
10	SW 1/4, Sec. 26, T10S, R24E	Uinta Fm., massive sandstone	Unidentifiable Wood fragments	Insignificant
11	NE 1/4, Sec. 5, T10S, R25E	Green River Fm., alternating shale and silty shale beds	Insects	Moderate
12	SC, Sec. 5, T10S, R25E	Green River Fm., alternating shale and silty shale beds	Insects	Moderate-Major
13	SW 1/4, Sec. 35, T10S, R24E	Uinta Fm., massive sandstone	Wood fragments	Insignificant
14	NW 1/4, Sec. 4, T10S, R25E	Green River Fm., shales and thin-bedded sandstone	Insects, plant fragments & some leaves	Moderate
15a,15b	NE 1/4, Sec. 8, T10S, R25E	Green River Fm., shales and thin-bedded sandstone	Insects & plant fragments	Minor-Moderate
15c	NW 1/4, Sec. 9, T10S, R25E	Green River Fm., shales and thin-bedded sandstone	Insects & plant fragments	Minor-Moderate
16	NW 1/4, Sec. 28, T10S, R25E	Green River Fm., silty shales	Insects, plant fragments & seeds	Moderate
17	NW 1/4, Sec. 16, T10S, R25E	Green River Fm., alternating shale, and oil shale	Insects	Moderate-Major
18	NE 1/4, Sec. 29, T10S, R25E	Lowermost Uinta Fm., massive sandstone, uppermost Green River Fm., thin-bedded shale	Plant fragments & some complete leaves	Minor-Moderate
19	NW 1/4, Sec. 32, T10S, R25E	Lowermost Uinta Fm., massive sandstone, uppermost Green River Fm., thin-bedded shale	Plant fragments & some complete	Minor-Moderate

Site #	Site Location	Site Description	Fossils Present	Significance
20	NE 1/4, Sec. 19, T10S, R24E	Uinta Fm., massive crossbedded sandstone	Turtle shell & bone & plant fragments	Moderate
21	NE 1/4, Sec. 31, T10S, R24E	Uinta Fm., channel sandstone	Some petrified wood	Minor
22	NE 1/4, Sec. 32, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Brontothere bones & turtle shell	Major
23	SE 1/4, Sec. 29, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Turtle shell fragments & wood fragments	Minor
24	NE 1/4, Sec. 19, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Brontothere teeth & turtle shell fragments	Major
25	WC Sec. 17, T10S, R24E	Uinta Fm., massive crossbedded sandstone	Petrified wood	Minor
26	SE 1/4, Sec. 18, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Brontothere teeth & turtle shell fragments	Major
27	NC, Sec. 16, T10S, R24E	Uinta Fm., massive crossbedded sandstone	Petrified wood	Minor
28	C, Sec. 21, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Brontothere bone & petrified wood	Moderate-Major
29	C, Sec. 28, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Petrified wood	Minor
30	NW 1/4, Sec. 33, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Turtle shell fragments	Minor

Site #	Site Location	Site Description	Fossils Present	Significance
31	SW 1/4, Sec. 3, NW 1/4, Sec. 10, WE 1/4, Sec. 9 T10S, R24E	Uinta Fm., channel sandstone	Brontothere teeth & bones	Major
32	WE 1/4, Sec. 22, T10S, R24E	Uinta Fm., alternating sandstone and siltstone	Unidentifiable bone fragments	Minor
33	C, Sec. 15, T10S, R24E	Uinta Fm., channel sandstone	Petrified wood	Minor
34	NE 1/4, Sec. 24, T10S, R24E	Green River Fm., thin-bedded shale	Fish scales	Minor
35	C, Sec. 20, T10S, R24E	Uinta Fm., massive sandstone	Wood fragments	Insignificant
36	NW 1/4, Sec. 27, T10S, R24E	Uinta Fm., massive sandstone	Wood fragments	Insignificant
37	SE 1/4, Sec. 13, T10S, R23E	Uinta Fm., alternating sandstone and siltstone	Fragmental plants & some complete leaves	Minor-Moderate
38	NW 1/4, Sec. 24, T10S, R23E	Uinta Fm., alternating sandstone and siltstone	Fragmental plants & some complete leaves	Minor-Moderate
39	N, Sec. 3, T10S, R24E	Uinta Fm., channel sandstone	Brontothere teeth & bones, alligator teeth & turtle shell	Major

APPENDIX E

APPENDIX E

Fossils occurring on Federal Oil
Shale Lease Tracts U-a and U-b,
Uintah County, Utah.

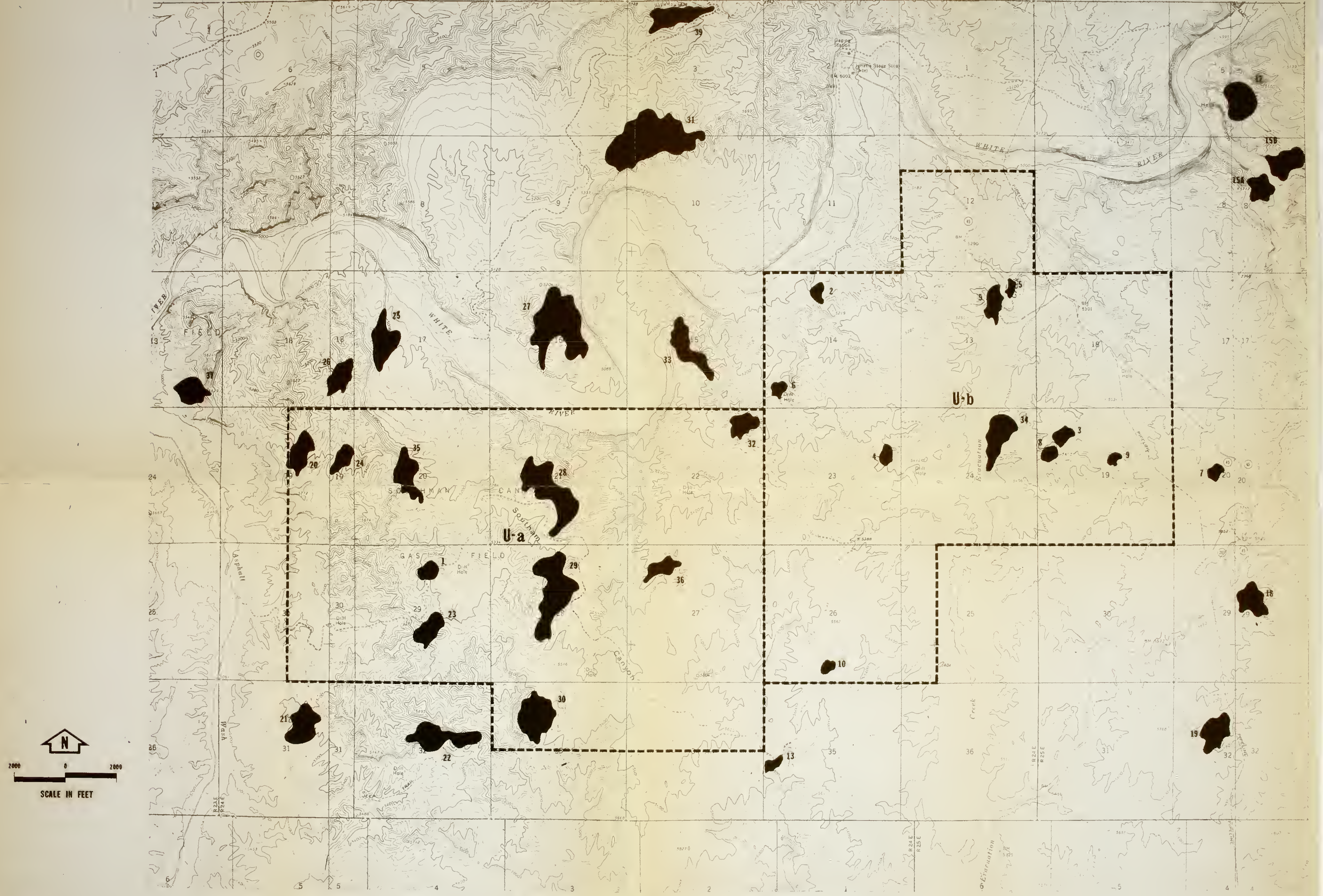
COMMON NAME	SCIENTIFIC NAME	FORMATION OF OCCURRENCE	
		Middle Eocene Green River Fm.	Late Eocene Uinta Fm.
PLANTS:			
Laurel	*Umbellularia*	X	
Poplar	*Populus*	X	
Willow	*Salix*	X	
Sycamore	*Platanus*	X	
INVERTEBRATES:			
March Flies	*Bibionidae*	X	
Flower Flies	*Syraphidae*	X	
Common Fly	*Musca*	X	
Bot Fly	*Lithohypoderma*	X	
Bot Fly	*Hypoderma*	X	
Soldier Fly	*Lithophysa*	X	
Crane Fly	*Tipula*	X	
Dragonfly	*Sympetrum*	X	
VERTEBRATES:			
Gar Pike	*Lepidosteus*	X	
Alligator	*Allognathosuchus*		X
Brontothere (large extinct mammal)	*Paleosyops*		X
"	*Eotitanops*		X
"	*Telmatherium*		X
"	*Dolichorhinus*		X
"	*Metarhinus*		X

APPENDIX F

Topographic Map Showing Fossil Localities in Relationship to Baseline Monitoring Sites

SOUTHMAN CANYON
GAS FIELD
Southam
U-a
5772
5674
5334
5400
1
Dr H
Hole
29
28
5316

APPENDICES
F+G


U-a
U-b
WHITE RIVER
WHITE RIVER
Southam Canyon
SOUTHAM CANYON
GAS FIELD
Asphalt Wash
Evacuation Creek
Drill Hole
N
2000 0 2000
SCALE IN FEET
1
2
3
4
5
6
7
8
9
10
12
13
15A
15B
16
17
18
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32
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34
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36
37
39
R23E R24E
R24E R25E

PALEONTOLOGICAL SITE MAP OF OIL SHALE TRACTS U-a & U-b

CHAMPION CLASP NO. 90 9 x 12

APPENDIX G

Topographic Map Showing Fossil Localities in Tracts U-a, U-b, and Vicinity

APPENDIX H

Consultant's Report on Fossil Insects

Fossil records of North American insects have been reported in the literature mostly from (1) Miocene and Pleistocene deposits of Ontario, Pennsylvania, and Florida, (2) Miocene deposits of Florissant, Colorado, and (3) Eocene deposits in the Green River formation of Wyoming. Considerably more than half of these fossils come from the Florissant; less than 5 percent are from the Green River Formation in Wyoming. Apparently there are very few published records of fossil insects from Utah for any geological period.

On 1 December 1974, Dr. Wade E. Miller and I examined the Green River Formation deposits at several points to determine the presence, extent, and scientific worth of insect fossils contained therein. While much of the shale was too soft or coarse to adequately preserve impressions of insects, some deposits contained excellent fossils of high quality. A beetle and a tipulid fly of scientific worth were found on the south side of a shallow road cut on Utah Highway 45 at about 5160 feet elevation (NE 1/4, Sec. 13, T10S, R24E). Fossil larval tipulids and other dipterous larvae were found on the east slope where Hell's Hole Canyon meets the White River, at an elevation of about 5100-5500 feet (SW 1/4, Sec. 5, T10S, R25E). Not all of the larval fossils were well-preserved, but many were in recognizable condition.

In view of the paucity of information about the fossil record of American insects, and most particularly of Utah insects, I strongly urge the collection and preservation of fossil insect material that may be encountered by any paleontological groups or projects in the area. As soon as sufficient material is available for study entomological specialists will be most anxious to study it.

The ecology of an area rigidly selects those species that can survive in a given habitat. Since the overwhelming majority of mega organisms in most

terrestrial and freshwater habitats are insects, and because various kinds of insects are further adapted to more restricted microhabitats, they provide one of the best indicators of the ecological conditions that existed in ancient habitats. For this reason, a knowledge of insect fossils contributes to other fields of science, as well as to that of entomology.

Stephen L. Wood
Professor of Entomology
Brigham Young University

APPENDIX I

United States Department of the Interior
NATIONAL PARK SERVICE
UTAH STATE OFFICE
125 S. STATE STREET
SALT LAKE CITY, UTAH 84138

IN REPLY REFER TO:
H22

February 10, 1975

Dr. Wayde Miller
Department of Zoology
Brigham Young University
Provo, Utah 84601

Dear Dr. Miller:

Enclosed is material relating to the Archeological and Historical Preservation Act (P.L. 93-291), which you requested.

Sincerely yours,

James L. Isenogle
Assistant to the Regional
Director, Utah

Enclosure

CONSERVE
AMERICA'S
ENERGY

Save Energy and You Serve America!

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO:
[illegible]

AUG 2 [illegible]

Memorandum

To: Regional Directors, Mid-Atlantic, Midwest, South
Southwest, Pacific Northwest, and Western Regi
Regional Directors, North Atlantic and Rocky Mou
Regions--information only

From: Acting Associate Director, Professional Services

Subject: Archeological and Historical Preservation Act

The Archeological and Historical Preservation Act (P.L. 93-291, copy enclosed) which became law on May 24, 1974, places major new responsibilities for coordination and professional oversight on the Secretary of the Interior. The Interagency Services Division is now preparing draft procedural and professional guidelines which deal with legal issues as well as important new definitional interpretations, scope of work and report preparation standards, and professional and organizational qualifications. These guidelines for the conduct of this program will soon be available for comment. The purpose of this memorandum is to discuss several related matters.

Section 7(a) of this new act authorizes each Federal agency to utilize construction project funds for archeological salvage. Section 7(b) authorizes an appropriation for the Secretary of the Interior to fund salvage in cases of Federal licenses, permits, grants, loans, etc. although no appropriation for this purpose will be available in fiscal year 1975. Section 7(c) authorizes the Secretary of the Interior to expend funds for traditional archeological salvage activities and is to be used as a transitional authority and appropriation until activities authorized by sections 7(a) and 7(b) can be adequately incorporated into the budget cycle. For this reason, the regional archeologists responsible for external archeological salvage program contracting should immediately contact those agencies and offices for whose projects they have programmed fiscal year 1975 salvage funds and seek to persuade those agencies to assume as much of the fiscal year 1975 costs as possible under the authority of section 7(a) of

P.L. 93-291. Mixed NPS-agency funding is acceptable if an agency is unable to reprogram enough funds to meet fiscal year [illegible] needs. NPS funds thus released will be reprogramed for archeological and historical conservation activities that would normally not be funded. We cannot stress too heavily the seriousness with which agencies should be approached on this matter. Much of our ability to carry out the intent of Congress this year pertaining to P.L. 93-291 rests upon getting agencies to assume their responsibilities as soon as possible. The results of these contacts and amounts available for reprograming should be communicated directly to the Chief, Interagency Services Division not later than October 15, 1974.

Funds to be transferred to the NPS under section 7(a) by other agencies should be made directly to the Washington Office. Guidelines on procedures to be followed are the subject of a separate memorandum now being prepared in Programs Control Division.

It is also necessary to systematize our information on available contractors. As a first approximation, the regional contracting archeologists should compile a list of all current and prospective contractors of whom they are aware; enclosed is a copy of the format to be used, with a separate page to be used for each agency, institution, or organization contractor. If any individuals have qualified or may qualify as contractors, they should be included also. We are also enclosing a copy of the draft "Appendix C: Professional qualifications" from the P.L. 93-291 procedures now under preparation. These should be used particularly with reference to commenting on institutional capability to meet contracting support needs. Copies of this information should be returned directly to the Chief, Interagency Services Division not later than September 30, 1974. Although every effort should be made to complete this list, lack of information on institutional capabilities should not deter providing the available data by September 30.

A R Mortensen

A. R. Mortenson

Enclosures

HISTORICAL, ARCHEOLOGICAL AND PALEONTOLOGICAL PRESERVATION ACT

Archeological and Historical Preservation Act

Public Law 93-291
93rd Congress, S. 514
May 24, 1974

AN ACT

88 STAT. 174

To amend the Act of June 27, 1960 (74 Stat. 220), relating to the preservation of historical and archeological data.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act entitled "An Act to provide for the preservation of historical and archeological data (including relics and specimens) which might otherwise be lost as the result of the construction of a dam", approved June 27, 1960 (74 Stat. 220; 16 U.S.C. 469), is amended as follows: "That it is the purpose of this Act to further the policy set forth in the Act entitled 'An Act to provide for the preservation of historic American sites, buildings, objects, and antiquities of national significance, and for other purposes', approved August 21, 1935 (16 U.S.C. 461-467), by specifically providing for the preservation of historical, and archeological, AND PALEONTOLOGICAL data (including relics, AND FOSSILS and specimens) which might otherwise be irreparably lost or destroyed as the result of (1) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of the terrain caused by the construction of a dam by any agency or (2) any alteration of the terrain caused as a result of any Federal construction project or federally licensed activity or program.

Historical and archeological data, preservation.

Extension to Federal or federally assisted projects.
16 USC 469a.

Sec. 2. Before any agency of the United States shall undertake the construction of a dam, or issue a license to any private individual or corporation for the construction of a dam it shall give written notice to the Secretary of the Interior (hereafter referred to as the "Secretary") setting forth the site of the proposed dam and the approximate area to be flooded and otherwise changed if such construction is undertaken: Provided, That with respect to any floodwater retarding dam which provides less than five thousand acre-feet of detention capacity and with respect to any other type of dam which creates a reservoir of less than forty surface acres the provisions of this section shall apply only when the constructing agency, in its preliminary surveys, finds, or is presented with evidence that historical, or archeological materials exist or may be present in the proposed reservoir area.

16 USC 469a-1.

Sec. 3. (a) Whenever any Federal agency finds, or is notified, in writing, by an appropriate historical or archeological authority, that its activities in connection with any Federal construction project or federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific, prehistorical, historical, ~~or~~ archeological data, such agency shall notify the Secretary, in writing, and shall provide the Secretary with appropriate information concerning the project, program, or activity. Such agency may request the Secretary to undertake the recovery, protection, and preservation of such data (including preliminary survey, or other investigation as needed, and analysis and publication of the reports resulting from such investigation), or it may, with funds appropriated for such project, program, or activity, undertake such activities. Copies of reports of any investigations made pursuant to this section shall be submitted to the Secretary, who shall make them available to the public for inspection and review.

Notification.

Data recovery, agency requests.

Reports, copies; availability.

Survey.

(b) Whenever any Federal agency provides financial assistance by loan, grant, or otherwise to any private person, association, or public entity, the Secretary, if he determines that significant scientific, ~~prehistorical~~, historical, ~~or archeological~~ data might be irrevocably lost or destroyed, may with funds appropriated expressly for this purpose conduct, with the consent of all persons, associations or public entities having a legal interest in the property involved, a survey of the affected site and undertake the recovery, protection, and preservation of such data (including analysis and publication). The Secretary shall, unless otherwise mutually agreed to in writing, compensate any person, association, or public entity damaged as a result of delays in construction or as a result of the temporary loss of the use of private or any non-federally owned lands.

archeological and paleontological [illegible]

Construction delays, compensation.

16 USC 469a-2.

Sec. 4. (a) The Secretary, upon notification, in writing, by any Federal or State agency or appropriate historical ~~or~~ archeological authority that scientific, ~~prehistorical~~, historical, ~~or archeological~~ data is being or may be irrevocably lost or destroyed by any Federal or federally assisted or licensed project, activity, or program, shall, if he determines that such data is significant and is being or may be irrevocably lost or destroyed and after reasonable notice to the agency responsible for funding or licensing such project, activity, or program, conduct or cause to be conducted a survey and other investigation of the areas which are or may be affected and recover and preserve such data (including analysis and publication) which, in his opinion,

[illegible] AND PALEO[illegible]

are not being, but should be, recovered and preserved in the public interest.

Emergency projects.

(b) No survey or recovery work shall be required pursuant to this section which, in the determination of the head of the responsible agency, would impede Federal or federally assisted or licensed projects or activities undertaken in connection with any emergency, including projects or activities undertaken in anticipation of, or as a result of, a natural disaster.

Initiation.

(c) The Secretary shall initiate the survey or recovery effort within sixty days after notification to him pursuant to subsection (a) of this section or within such time as may be agreed upon with the head of the agency responsible for funding or licensing the project, activity, or program in all other cases.

Construction delays, compensation.

(d) The Secretary shall, unless otherwise mutually agreed to in writing, compensate any person, association, or public entity damaged as a result of delays in construction or as a result of the temporary loss of the use of private or non-federally owned lands.

74 Stat. 220.
16 USC 469a.
16 USC 469a-3.

Sec. 5. (a) The Secretary shall keep the agency responsible for funding or licensing the project notified at all times of the progress of any survey made under this Act, or of any work undertaken as a result of such survey, in order that there will be as little disruption or delay as possible in the carrying out of the functions of such agency and the survey and recovery programs shall terminate at a time mutually agreed upon by the Secretary and the head of such agency unless extended by mutual agreement.

(b) The Secretary shall consult with any interested Federal and State agencies, educational and scientific organizations, and private institutions and qualified individuals, with a view to determining the ownership of and the most appropriate repository for any relics and specimens recovered as a result of any work performed as provided for in this section.

Coordination.
Annual report to congressional committees.

(c) The Secretary shall coordinate all Federal Survey and recovery activities authorized under this Act and shall submit an annual report at the end of each fiscal year to the Interior and Insular Affairs Committees of the United States Congress indicating the scope and effectiveness of the program, the specific projects surveyed and the results produced, and the costs incurred by the Federal Government as a result thereof.

16 USC 469b.

Sec. 6. In the administration of this Act, the Secretary may--

(1) enter into contracts or make cooperative agreements with any Federal or State agency, any educational or

scientific organization, or any institution, corporation, association, or qualified individual; and

Experts and consultants.
80 Stat. 416

(2) obtain the services of experts and consultants or organizations thereof in accordance with section 3109 of title 5, United States Code; and

Funds acceptance.

(3) accept and utilize funds made available for salvage archeological purposes by any private person or corporation or transferred to him by any Federal agency.

Funds, transfer.
16 USC 469c.

Sec. 7. (a) To carry out the purposes of this Act, any Federal agency responsible for a construction project may assist the Secretary and/or it may transfer to him such funds as may be agreed upon, but not more than 1 per centum of the total amount authorized to be appropriated for such project, except that the 1 per centum limitation of this section shall not apply in the event that the project involves $50,000 or less: Provided, That the costs of such survey, recovery, analysis, and publication shall be considered nonreimbursable project costs.

Appropriation.

(b) For the purposes of subsection 3(b), there are authorized to be appropriated such sums as may be necessary, but not more than $500,000 in fiscal year 1974; $1,000,000 in fiscal year 1975; $1,500,000 in fiscal year 1976; $1,500,000 in fiscal year 1977; and $1,500,000 in fiscal year 1978.

88 STAT. 176

(c) For the purposes of subsection 4(a) there are authorized to be appropriated not more than $2,000,000 in fiscal year 1974; $2,000,000 in fiscal year 1975; $3,000,000 in fiscal year 1976; $3,000,000 in fiscal year 1977; and $3,000,000 in fiscal year 1978.

Approved May 24, 1974

LEGISLATIVE HISTORY:

HOUSE REPORT No. 93-992 accompanying H.R. 296 (Comm. on Interior and Insular Affairs).
SENATE REPORT No. 93-163 (Comm. on Interior and Insular Affairs).
CONGRESSIONAL RECORD:
Vol. 119 (1973): May 22, considered and passed Senate.
Vol. 120 (1974): May 6, considered and passed House, amended, in lieu of H.R. 296.
May 9, Senate agreed to House amendments.

United States Department of the Interior

OFFICE OF THE SOLICITOR

DENVER REGION
P.O. BOX 25007
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

APR 16 1974

Memorandum

To: State Director, Bureau of Land Management, Wyoming

From: Regional Solicitor, Denver

Subject: EIS Responsibility; National Historic Preservation Act and Executive Order 11593

In your memorandum of April 2, 1974, you ask, in substance, whether BLM can require a professional historical and archeological survey of the surface of lands to be strip mined by withholding approval of plans that do not provide for such surveys. Your question is based on the assumption that a lease has been issued without stipulations requiring such surveys.

To our knowledge the question of whether the Bureau of Land Management can, by the above-described procedure, require a coal lessee to make an intensive survey has not been previously decided by the Department or judicial proceedings. We are of the opinion that the Bureau of Land Management should take the position that professional surveys must be a part of a mining plan. We believe that the Bureau's position should be the same whether the surface be in private or public ownership.

If we can be of further assistance in this matter, please let us know.

Lowell L. Madsen
Lowell L. Madsen
For the Regional Solicitor

cc: Assistant Solicitor, Lands, Energy & Resources
Attn: Mr. Grayson

RECEIVED
Bureau of Land Management
State Director

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
DENVER SERVICE CENTER
DENVER FEDERAL CENTER, BUILDING 50
DENVER, COLORADO 80225

IN REPLY REFER
6230 (D-37

May 20, 1974

Memorandum

To: Richard Fike, Archeologist, Utah State Office

From: Cultural Resource Specialist (Archeologist) Lloyd Pierson, DSC

Subject Fossils

As you can see from the attached opinions and decisions, fossils are taken care of and protected under the Antiquities Act of 1906, we are responsible for them and the Montana Decision says we can put darn near anything we wish into lease stipulations whether we own the surface or not. The National Environmental Policy Act Section 101 (b) (4) says "preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible an environment which supports diversity and variety of individual choice". We interpret fossils to fall into all three catagories above as they are certainly natural, they are part of [illegible] history and, if recent enough, part of man's history, and last, they [illegible] to the cultural category in that they are educational and scientific in nature. The National Park Service, as the Department's administrator of the Antiquities Act, automatically declares any vertebrate fossils important, other fossils would probably need some determination, if you know they are present, by a paleontologist to see about their scientific importance. An on the ground survey would be the best way to accomplish this.

Enclosures: As stated

cc: WO-370

United States Department of the Interior

OFFICE OF THE SOLICITOR
WASHINGTON, D.C. 20240

N REPLY REFER TO:

Memorandum

To: Director, Bureau of Land Management
Through: Assistant Secretary, Public Land Management

From: Associate Solicitor, Division of Public Lands

Subject: Applicability of the Antiquities Act to Fossils

You have asked whether fossils are included within the scope of the Antiquities Act of June 8, 1906, (34 Stat. 225, 16 U.S.C. §§ 432, 433). This question must be answered in the affirmative.

Three memoranda have been written in the Solicitor's office on the general question of fossils and the Antiquities Act, _supra_. The latest of these is from the Regional Solicitor at Salt Lake City to the Utah State Director of the Bureau of Land Management dated July 10, 1963 (copy attached). The Regional Solicitor held that fossils are covered by the Antiquities Act but such coverage extends only to such fossils which are of an actual and real historic or scientific interest and of some unusual significance.

These same two principles were first enunciated in an opinion of the Solicitor of January 19, 1959 (copy attached), dealing solely with petrified wood and in which it was held that most deposits of petrified wood were not of sufficient historic or scientific interest to qualify under the Antiquities Act.

The earliest of these three memoranda was from the Assistant Solicitor for National Parks to the Chief Clerk, dated October 12, 1956 (copy attached) and expressly held that fossils were covered by the Antiquities Act. This opinion recited the long history of this Department in interpreting the Antiquities Act to include fossils. Long continued interpretation should be

given great weight, see *United States v. Midwest Oil Co.*, 236 U.S. 459, 472 (1915), and *Sioux Band of Indians v. United States*, 316 U.S. 317, 325, (1942).

The Congress of the United States on August 15, 1949, in 63 Stat. 606 (20 U.S.C. §§ 78, 78a), expressly ratified this interpretation. This act expressly states that cooperative work to preserve fossils on lands of the United States shall be done under the provisions of sections 431, 432, and 433 of title 16 (the Antiquities Act). It provides in part:

> "The Secretary of the Smithsonian Institution is authorized to cooperate with any State, educational institution or scientific organization in the United States for continuing paleontological investigations, and the excavation and preservation of fossil remains, in areas which will be flooded by the construction of Government dams or otherwise be made unavailable for such investigations because of such construction: *Provided*, That such investigation and activities shall not duplicate nor affect adversely similar operations being conducted by the Department of the Interior in cooperation with the Smithsonian Institution.
>
> ...*Provided further*, That where lands are involved which are controlled by the Government of the United States, cooperative work thereon shall be under the provisions of sections 431, 432, and 433 of Title 16, and rules and regulations pertaining thereto."

Though the particular act just cited is limited in its specific application, it is evident that Congress knew and approved this Department's long standing interpretation of the meaning of "antiquity" to include fossils.

Section 1 of the Antiquities Act *supra* imposes certain penal sanctions for appropriating, excavating, injuring, or destroying any historic or prehistoric ruin or monument or any object of antiquity by any person not holding a permit from the head of the agency having jurisdiction over the lands on which such ruins, monuments or antiquities are situated. Section 2 provides that these permits may be issued only to certain institutions for very limited purposes. This act definitely prohibits the practice of

the commercial collection of fossils for resale. Furthermore, it does not authorize even the collection of common or unimportant fossils by amateur collectors. This does not mean that the Department should bring criminal prosecution against such amateur collectors, because conviction on such a charge is a serious blot on an individual's record.

Commercial collectors and sellers of fossils may try to defend their actions by claiming that they are taking valuable mineral deposits, but this contention was expressly overruled by this Department in Earl Douglass, 44 L.D. 325 (1915). In this case Dinosaur fossils, or any other fossils, were held not to be subject to mining location. The non-applicability of the mining laws to such items as meteorites, fossils, stalactites, stalagmites, etc., has been reiterated as recently as March 7, 1961, in a letter from the Solicitor to Senator Maurine Neuberger (copy attached).

David E. Lindgren

Enclosures

MUSEUM OF COMPARATIVE ZOOLOGY
HARVARD UNIVERSITY
CAMBRIDGE, MASS. 02138

May 16, 1975

Mr. Charles M. McKinney
Staff Archeologist to the
Departmental Consulting Archeologist
Department of the Interior
Office of Archeology & Historic Preservation
Interagency Services Division
Washington, D. C. 20240

Dear Mr. McKinney:

I was interested to learn, in our telephone conversation yesterday, that the Department of Interior plans to propose changes in the scope of the Federal Antiquities Act that would relate to vertebrate paleontology field work on federal lands. As you are aware, professional vertebrate paleontologists throughout the country have a direct and vital interest in any such legislative changes. The protection of fossiliferous localities and the preservation of paleontological materials have long been our collective concerns. However, it is equally important to the future development of this science that regulatory mechanisms do not impede qualified professionals and institutions in pursuing legitimate scientific activities.

In response to your request, I am enclosing an abbreviated list of professionals (and institutions) to whom you might send a copy of the proposed changes. I understand that these proposals will appear in The Federal Register for the purpose of eliciting public review and comment, and your office especially welcomes correspondence on the matter from professional vertebrate paleontologists.

I earnestly hope that the schedule for these proposed changes will allow time for careful and considered deliberation by all interested parties. Please keep in mind that most vertebrate paleontologists participate in various field activities during the summer months, and a full response to any mailing of the Federal Register during this time probably cannot be accomplished until September.

With many thanks for your helpfulness and concern in this matter,

Yours sincerely,

Farish A. Jenkins, Jr.
Professor of Biology
Curator, Vertebrate Paleontology

FAJJr:[illegible]

cc: as per attached list
encl: mailing labels for above

Wade —
Warren Langston tells me that you're very much interested in these sorts of matters. I hope that SVP can offer your constructive input. Regards,

Baird, D.
Black, C. C.
Bolt, J. R.
Clemens, W. A. Jr.
Colbert, E. H.
Coombs, W.
Dawson, M.
Dorr, J. A. Jr.
Emry, R. J.
Gingerich, P. D.
Gregory, J. T.
Hotton, N.
Hunt, R.
Jensen, J. A.
Langston, W., Jr.
Lillegraven, J. A.
MacDonald, J. R.
McGrew, P. O.
McKenna, M. C.
Morris, W. J.
Olson, E. C.
Ostrom, J. H.
Robinson, P.
Savage, D. E. G.
Schaeffer, B.
Schultz, G.
Semken, H. A. Jr.
Singer, R.
Simons, E. L.
Simpson, G. G.
Slaughter, B. H.
Sloan, R. E.
Turnbull, W. D.
Vaughn, P. P.
Webb, S. D.
West, R. M.
Wilson, J. A.
Wilson, R. W.
Woodburne, M. O.
Miller, W. E.
Whistler, D. P.

1973

(UTAH STATE ANTIQUITIES)

Engrossed Copy

H. B. No. 34

By David R. Irvine
John P. Redd

AN ACT CREATING WITHIN THE DIVISON OF STATE HISTORY A STATE ANTIQUITIES SECTION TO ESTABLISH ARCHAEOLOGICAL SITES, FOR THE COLLECTION AND PRESERVATION OF SPECIMENS AND RECORDS AND FOR THE EDITING AND PUBLICATION OF ANTIQUITIES RECORDS; PROVIDING FOR THE CREATION AND COMPOSITION OF AN ANTIQUITIES COMMITTEE TO ADVISE THE STATE BOARD OF HISTORY IN POLICY MATTERS RELATED TO ANTIQUITIES; AND PROVIDING PENALTIES.

Be it enacted by the Legislature of the State of Utah:

Section 1. The legislature declares that the public has an interest in the preservation and protection of the state's archaeological and anthropological resources and a right to the knowledge derived and gained from scientific study of those resources. It is the purpose of this act to provide that activities for the preservation, excavation, study and exhibition of the state's archaeological and anthropological resources be undertaken in a coordinated and organized manner for the general welfare of the public.

Section 2. As used in this act:

(1) "Specimens" means all man-made relics, artifacts, and remains of a prehistorical, archaeological, or anthropological nature found on or below the surface of the earth.

(2) "Site" means any aboriginal mound, fort, building, earth work, village location, burial ground, prehistoric ruin, cave, petroglyphs, pictographs, or other location which is the source of specimens.

Section 3. There is created within the division of state history a state antiquities section. The division of state history is the authority of the state for the protection and orderly development of archaeological

and anthropological resources.

Section 4. The state antiquities section is responsible for the stimulation of research, study, and activities in the field of antiquities; the marking, protection, and preservation of sites; the collection, preservation, and administration of specimens and records; and the editing and publication of antiquities records. The section shall cooperate with local, state, and federal agencies and all interested persons to achieve the purposes of this act.

Section 5. An antiquities committee consisting of the chairman and vice-chairman of the board of state history, director of the division of state history, director of the division of parks and recreation, director of the museum of natural history, two professional archaeologists and three other persons from various geographical areas of the state with demonstrated interest in antiquities, one of whom shall be an Indian, is created to advise the board of state history in matters related to antiquities. The professional archaeologists and three interested persons shall be appointed by the governor.

The gubernatorial appointee members shall serve four years. Members shall serve without compensation but are entitled to reimbursement for their necessary and actual expenses. The antiquities committee may advise the board on matters of policy for the antiquities section.

Section 6. The governor shall extend an invitation to participate on the antiquities committee to the regional forester of the United States Department of Agriculture for the intermountain region, the state director of the bureau of land management, and the state director of national park service areas for Utah.

Section 7. The director of the division of state history, upon recommendation of the antiquities committee, shall select the state archaeologist who may create a staff to carry out the policies assigned him by the board of state history.

Section 8. It is unlawful for any person to enter a site located on state land or lands owned or controlled by the state or its subdivisions,

or which have been designated as landmarks pursuant to this act, for the purpose of appropriating, injuring, or destroying a specimen without a permit from the division of state history. Application for a permit shall be made on a form furnished by the antiquities section and accompanied by the payment of a fee or posting of a bond to be determined by the board of state history. All archaeological work shall be carried out under the supervision of the state archaeologist under the direction of the division director and in accordance with rules adopted by the board of state history in such a manner that the maximum amount of historic, scientific, archaeological, anthropological, and educational information may be recovered and preserved in addition to the physical recovery of items. The division of state history may revoke or suspend a permit or declare the bond to be forfeited if the permitee fails to conduct the excavation in a manner consistent with rules promulgated by the state antiquities section. All items recovered by permitees shall be the property of the state; provided, that the board of state history with the advice of the antiquities committee may allot a fair share of the items recovered to the permitee. A permitee may be required to submit duplicates of any written or photographic data obtained in the course of field investigations to the division of state history.

Section 9. Sites of significance may be recommended to the governor's historic and cultural sites review committee by the antiquities committee with the approval of the board of state history as "state archaeological or anthropological landmarks," provided that no privately owned site shall be so designated without the written consent of the owner. It is unlawful to excavate upon a privately owned designated site without a permit from the division of state history. Before any alteration is commenced on a designated landmark, three months' notice of his intent to alter the site shall be given the division of state history.

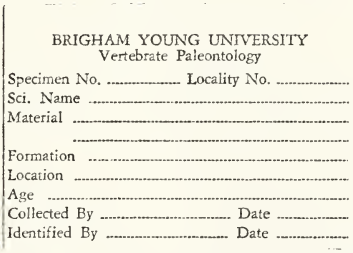
Section 10. Any person who discovers any site or specimen on lands owned by the state shall promptly report such discovery to the division of state history. It is the intention of the legislature that discovery on

APPENDIX J

APPENDIX J

Identification of Specimens

As specimens were brought in from the field they were unwrapped and placed in trays. A label was placed with the specimens which was filled in to include all relevant data. A sample card is shown here. Identifications were made only to the taxonomic level possible in a reasonable length of time. More detailed identifications will be made some time after the survey project has been completed, either by myself or by students who wish to work on them as they relate to various studies. Identifications were made by comparing specimens to previously identified ones in the collection (or when necessary in the collection of another institution) and by using pictures and data found in the literature.



BRIGHAM YOUNG UNIVERSITY
Vertebrate Paleontology

Specimen No. .... Locality No. ....
Sci. Name ....
Material ....
....
Formation ....
Location ....
Age ....
Collected By .... Date ....
Identified By .... Date ....

Some preparation was needed in order to properly identify specimens. This meant the removal of part of all the matrix surrounding a fossil. This work was kept to a minimum for the survey. Complete preparation will be done later in conjunction with a detailed study of the fossils.

All fossils collected during the survey are now contained in special storage cabinets as part of the Brigham Young University fossil collection. These specimens will always be available for inspection by interested persons either in or outside the institution.

APPENDIX K

APPENDIX K

Procedure for Recording Field Notes

1. Use three-hole looseleaf notebook for all field notes. Size of paper should be approximately 9 inches by 6 inches; lined paper with left-hand margin is preferred.

2. Write on one side of page only.

3. Use medium grade of pencil hardness: 2-3 or F.

4. Each new locality is to be given a separate field number which should consist of the author's full initials, the last two digits of the year and the consecutive number of the locality (e.g., The fifth locality discovered in 1972, would be recorded as WEM 725).

5. Consecutively number pages in notebook, top center of page.

6. Enter date.

7. Record locality.

8. Record information, and where possible the member, from which fossils were recovered.

9. Record name of topographic map which relates to area of fossil site.

10. Body of notes for each field number should include the following:

    a. Distance and direction from nearest well-established point (e.g., highway intersections, town, confluence of streams, etc.)

    b. Part of section, section, township, and range

    c. Sketch map relating fossil site to nearest reference point if helpful

    d. Briefly describe stratigraphy and lithology

    e. Identify fossils as to taxa and material represented (insofar) as possible)

    f. Relate condition of fossils and any other noteworthy data (try to keep data factual and speculations to a minimum)

    g. Identify people in field party

Sample Entry

P. 3

WEM 74-3
June 13, 1974
Vernon Chard Ranch
Eastern Wyoming

S.E. Powder River Basin
U.S.G.S. Map, OM-185
1957
Brule FM. (M. Oligocene)

Fossil Site, Center of Section 19, T34N, R 60 W

From small school bldgs., NE 1/4, Sec. 12, T34N, R 61 W (See notes for WEM 73-19, p. 22), head east on dirt rd. 1.9 mi., turn south (right), go 1.3 mi. & stop. Site 25-75 yds. to west.

White channel ss. just below rd. level. Some fossils here, difficult to remove intact, not collected at this time. Buff-colored mudstone (ms.) beneath ss. yielded many fossils which were collected. Ms. well sorted, horizontal bedding. Thin intersecting $CaCo_3$ seams present.

Gen'l area one of grasslands dissected by numberous ravines which produce a condition of badlands. Pine covered ridge to south at higher elevation.

Numerous fossils weathering in place, buff-colored & usually well permineralized. Articulation & association of skeletal elements common. Field identifications include: oredont (numerous), rodents (common), leptomerycid (common), brontothere (scarce), horse (common), rhino (scarce), entelodont (scarce), carnivore (scarce) & numerous tortoises. Bones & teeth in very good condition, very little abrasion. No pattern was noted in arrangement of fossils.

Field party - myslef & B.Y.U. spring field class in paleontology (See WEM 74-1, P. 1).

Polaroid pictures taken.

APPENDIX L

RESUME

NAME: Wade E. Miller

TITLE: Associate Professor of Zoology and Geology

BIRTHDATE: October 20, 1932

BIRTHPLACE: Los Angeles, California

ADDRESS: Department of Zoology
Brigham Young University
Provo, Utah 84602
(801-374-1211 Ext. 2467)

2871 Indian Hills Drive
Provo, Utah 84601
(801-375-5058)

ACADEMIC RECORD:

Institution and Location	Degree		Dates Attended
El Camino College, Torrance, CA	AA		1955-1957
Brigham Young University, Provo, UT	BS	Geology	1958-1960
Calif. State University, Long Beach, CA	NA		Summer, 1961
University of Arizona, Tucson, AZ	MS	Geology Paleontology	1960-1962
University of California, Berkeley, CA	Ph.D.	Paleontology	1964-1968

EMPLOYMENT RECORD:

U. S. Army Infantry, Instructor, 1953-1954
Parker Aircraft Co., part time, Lab Technician, 1955-1957
Santa Ana College, Instructor, 1961-1964
University of California (Berkeley), Teaching Assistant, 1964-1966
Fullerton Junior College, Instructor, 1968-1971
Brigham Young University, Assoc. Prof. of Zoology and Geology, 1971-present

RESEARCH AND OTHER CREATIVE PRODUCTIVITY:

Project	Sponsor	Dates	Amount of Grant
Preparation and curation of Osteological Specimens (for research and teaching)	BYU and self	1971-present	Unfunded
Preparation and curation of Paleontological specimens (for research and teaching)	BYU and self	1971-present	Unfunded
Development of a program in Vertebrate Paleontology	BYU Research Division	1972-1973	$5,100

Project	Sponsor	Dates	Amount of Grant
Collection and study of Cenozoic Vertebrates from Utah	BYU Research Division	1973-1974	$ 3,175
Collection and study of Pleistocene Vertebrates from Lake Bonneville deposits	National Geographic Society	1974-present	$ 4,555
Impact study on fossils from oil shales in the Uinta Basin, Tracts U-a and U-b	VTN Corp.	1974-present	$30,783

COURSE DEVELOPMENT:

New course and lab in Vertebrate Paleontology, 1971
New course in Paleontological Field Methods, 1972
New course and lab in Comparative Osteology, 1973

ACADEMIC AND PROFESSIONAL HONORS:

Graduate Scholarship, University of Arizona, 1961
Teaching Assistantship, University of California (Berkeley), 1964-1966
National Science Foundation Fellowship, University of California (Berkeley, 1966-1968
Research Associate, Los Angeles County Museum, 1968-present

PROFESSIONAL EXPOSURE:

I have visited many of the major museums in the United States to become familiar with their techniques and collections, and to obtain specimens and casts of important fossil vertebrates. I have participated with various professional groups in paleontological field work.

PROFESSIONAL MEMBERSHIPS AND MEETINGS:

1. Memberships

Society of Vertebrate Paleontology
American Society of Mammalogists
Southern California Academy of Sciences
The Paleontological Society

2. Meetings attended during past five years

*Society of Vertebrate Paleontology
*Southern California Academy of Sciences
Utah Academy of Arts, Science and Letters
Society of Economic Paleontologists and Mineralogists
*Cordilleran Section of the Geological Society of America

*Meetings in which I presented papers.

PUBLICATIONS:

Miller, Wade E. 1966. Late Pleistocene Mammals from Palos Verdes, California. Geol. Soc. American, Special Papers, No. 101:323-324.

______________. 1968. Occurence of a Giant Bison, Bison Latifrons, and a Slender-Limbed Camel, Tanupolama, at Rancho La Brea. Los Angeles Co. Mus., Contrib. Sci. 147:1-9.

______________. 1969. A new fossil vertebrate locality in southern California. Earth Science 22(4):161-166.

______________. 1971. Pleistocene Vertebrates of the Los Angeles Basin and Vicinity. Los Angeles Co. Mus., Bull., Sci. 10:1-124.

______________ and Theodore Downs. 1971. A Middle Pliocene Fauna from Hungry Valley, Southern California. Abstracts, Cordilleran Section, Geological Society of America, 3(2):160-161.

Miller, Wade E. 1973. A Pleistocene Mammalian Fauna from Utah. Geol. Soc. Amer., Abstracts with Programs, 5(1):81.

______________ and Theodore Downs. 1974. A Hemphillian Local Fauna Containing a New Genus of Antilocaprid from Southern California. Los Angeles Co. Mus., Contrib. Sci. 258:1-36.

Miller, Wade E. Two sections in the forthcoming book, "Latter-Day Saint Scholars Speak." Chapter III, Applications of Dating, Section 4, Response of the Fauna; Chapter VII, Early Man in a Changing World, Section 1, Prehistory of Primates and Man. (In press)

______________. A New Pronghorn from California. Terra. (In press)

SPECIAL SERVICES:

I have given many talks before school, church and other groups outside Brigham Young University classes, and have given workshops in paleontology. I am continually dealing with the public, dispensing information relating to paleontology.

BIBLIOGRAPHY

Abbott, W., 1957. Tertiary of the Uinta Basin; in Intermtn. Assoc. Petr. Geol. Guidebook, 8 ann. Fld. Conf., 1957, p. 102-109.

Baer, J. L., 1969. Paleoecology of cyclic sediments of the Lower Green River Formation, Central Utah; B.Y.U. Geol. Studies, V. 16 Pt. 1, p. 3-96.

Baer, J. L., 1969. Cyclic nature of the sedimentary features of the Lower Green River Formation of Central Utah [Abst.]; Geol. Soc. Amer. Spec. Paper 121, p. 586-687.

Bissell, H. J., 1968. Bonneville, an Ice Age Lake; B.Y.U. Geol. Studies Vol. 15, Pt. 4, pp. 1-66.

Black, C. C., 1968. The Uintan rodent Mytonomys: Jour. Paleon., V. 42 No. 3, p. 853-856.

Black, C. C. 1970. A New Pareumys (Rodentia: Cylindrodontidae) from the Duchesne River Formation, Utah; Fieldiana, Geol., V. 16, No. 17, pp. 453-459.

Black, C. C. and Dawson, M. R., 1966. A Review of late Eocene Mammalian faunas from North America: Am. Jour. Sci., V. 264, p. 321-249.

Bradley, W. H., 1929. The occurrence and origin of analcite and meerschaum birds in the Green River Formation of Utah, Colorado, and Wyoming; U.S. Geol. Surv., Prof. Paper 158-A, p. 1-7.

Bradley, W. H., 1929 a. Algae reefs and oolites of the Green River Formation; U.S. Geol. Surv. Prof. Paper 154, p. 203-223.

Bradley, W. H., 1929 b. The varves and climate of the Green River Epoch; U. S. Geol. Surv. Prof. Paper 158-E, p. 87-110.

Bradley, W. H., 1931. Origin and microfossils of the oil shale of the Green River Formation of Colorado and Utah; U.S. Geol. Survey Prof. Paper, V. 168, pp. 1-58.

Bradley, W. H., 1948. Limnology of the Eocene Lakes of the Rocky Mountain Region; Geol. Soc., Am. Bull., V. 59, No. 7, pp. 635-648.

Bradley, W. H., 1964. Geology of Green River Formation and Associated Eocene rocks in Southwestern Wyoming and adjacent parts of Colorado and Utah; U.S. Geol. Surv. Prof. Paper 496-A, pp. A1-A86.

Burke, J. J., 1934. New Duchesne River Rodents and A Preliminary Survey of the Adjidaumidae; Ann., Carnegie Mus., V. 23, pp. 391-398.

Burke, J. J., 1934. Mytonolagus, a New Genus from the Uinta Eocene Series in Utah; Ann. Carnegie Mus., V. 23, pp. 399-420.

Burke, J. J., 1935. Fossil Rodents from the Uinta Eocene Series; Ann. Carnegie, Mus., V. 25, p. 5-12.

Burke, J. J., 1935. Preliminary report on fossil mammals from the Green River Formation in Utah; Ann. Carnegie Mus., V. 25, p. 13-14.

Carpenter, F. M., 1955. An Eocene Bittacus (Mecoptera) [Utah]; Psyche, V. 62, No. 1, p. 39-41.

Cope, E. D., 1885. The Vertebrata of the Tertiary Formations of the West: U. S. Geol. Surv. Terr. Rpt., V. 3, 35, pp. 1-1009.

Curry, H. D., 1964. Oil-content correlations of Green River oil shales, Uinta and Piceance Creek Basins; in Intermtn. Assoc. Petr. Geol. Guidebook, 13 Ann. Fld. Conf., 1964, pp. 169-171.

Cashion, W. B., 1967. Geology and fuel resources of the Green River Formation, southeastern Uinta Basin, Utah and Colorado; U. S. Geol. Surv. Prof. Paper 548, p. 1-48.

Cashion, W. B. and J. H. Brown, 1956. Geology of the Bonanza-Oregon oil shale area, Uintah County, Utah and Rio Blanco County, Colorado; U. S. Geol. Surv. Oil and Gas Inv. Map OM-135.

Chatfield, J., 1965. Petroleum goelogy of the greater Redwash Area, Uintah County; Utah; Mtn. Geologist, V. 2, No. 3, pp. 115-121.

Curry, H. D., 1957. Fossil tracks of Eocene vertebrates, Southwestern Uinta Basin, Utah; in Intermtn. Assoc. Petrol. Geol. Guidebook, 8 Ann. Field Conf. 1957, p. 42-47.

Dane, C. H., 1954. Stratigraphic and facies relationships of Upper Part of Green River Formation and Lower Part of Uinta Formation in Duchesne, Uintah, and Wasatch Counties, Utah; Amer. Assoc. Petr. Geol. Bull., V. 38, No. 3, pp. 405-425.

Davis, C. H., 1916. Algae of Petroleum-yielding shales of Green River Formation; Nat. Acad. Sci., V. 2, pp. 114-119.

Dawson, M. R., 1968. Middle Eocene rodents (Mammalia) from Northeastern Utah; Carnegie Mus. Ann., V. 39, Art. 20, pp. 327-370.

Desborough, G. A., 1973. Microprobe of analysis of Biotites--a method of correlating tuff beds in the Green River Formation, Colorado and Utah; U. S. Geol. Surv. Jour. Res., V. 1, No. 1, p. 39-44.

Douglass, E., 1909. Preliminary descriptions of some new titanotheres from Uinta deposits; Carnegie Mus. Ann., V. 6, No. 1, pp. 304-313.

Douglass, E., 1914. Geology of the Uinta Formation; Geol. Soc. Am. Bull., V. 25, p. 417-420.

Eicher, D. L., 1968. Geologic Time; Prentice-Hall, Inc., pp. 1-149.

Gazin, C. L., 1955. A review of the Upper Eocene artiodactyla of North America; Smith. Misc. Coll., V. 128, No. 8.

Gazin, C. L., 1959. Paleontological exploration and dating of the Early Tertiary deposits in basins adjacent to the Uinta Mountains; Intermtn. Assoc. Petrol. Geol., Guidebook, 10 Ann. Field Conf. 1959, p. 131-138.

Gazin, C. L., 1968. A study of the Eocene condylarthan mammal *Hyopsodus*; Smith. Misc. Coll., V. 153, No. 4, p. 1-90.

Gillmore, C. W., 1946. A new crocodilian from the Eocene of Utah; Jour. Paleontology, V. 20, No. 1, p. 62-67.

Good, J. M., 1957. Dinosaur National Monument: pp. 40-41.

Gregory, W. K., 1912. Note on the Upper Eocene Titanotheroid *Telmatherium Incisivum* Douglass from the Uinta Basin: Science, V. 35, p. 546.

Hansen, G. H., 1928. Hairy mammoth skeleton in Utah; Utah Acad. Sci., Arts and Letters, V. 6, pp. 7-8.

Hardy, C. T., 1963. Tertiary stratigraphy of Utah, *in* Oil and Gas possibilities of Utah, re-evaluated; Utah Geol. and Mineral. Surv. Bull. 54, pp. 141-146.

Hayden, F. V., 1869. Review of Leading Groups, in U. S. Geol. Surv. Terr. 3 Ann. Rpt., pp. 189-192.

Hintze, L. F., 1974. Geologic History of Utah; B.Y.U. Geol. Studies, V. 20, Pt. 3, pp. 1-181.

Holland, W. J., 1924. Description of the type of Uintasaurus Douglassi, Holland; Ann. Carnegie Mus., V. 15, Nos. 2 and 3, pp. 119-138.

Hunt, J. M., F. Stewart and P. A. Dickey, 1954. Origin of Hydrocarbons of Uinta Basin, Utah: Am. Assoc. Petr. Geol. Bull., V. 38, No. 8, p. 1671-1698.

Kay, J. L., 1934. The tertiary formations for the Uinta Basin; Ann. Carnegie Mus., V. 23, pp. 357-371.

Kay, J. L., 1953. Early history of the Uinta Basin; Soc. Vertebrate Paleontology Guidebook, 6 Ann. Field Conf., Aug., 1953, pp. 20-24.

Kay, J. L., 1957. The Eocene Vertebrates of the Uinta Basin, Utah: Intermtn. Assoc. Petr. Geologists, Guidebook, 8 ann. Field Conf., 1957, pp. 110-114.

Kayser, R. B., 1966. Bituminous sandstone deposits, Asphalt Ridge, Uinta County, Utah: Utah Geol. and Min. Serv. Spec. Studies 19, pp. 1-62.

King, C., 1870. The Green River Coal Basin; U. S. Geol. Exploration of 40 parallel, Clarence King, V. 3, Mining Industry, p. 451-458, 466-473, 4°.

Knowlton, F. H., 1923. Revision of the flora of the Green River Formation; U. S. Geol. Surv. Prof. Paper 131, pp. 133-182.

MacGinitie, H. D., 1969. The Eocene Green River flora of northwestern Colorado and Northeastern Utah; California University Publ. Geol. Sci., V. 83, pp. 1-203.

Marsh, O. C., 1885. The Gigantic Mammals of the Order Dinocerata, in U. S. Geol. Survey 5 Ann. Rpt. to Sec. Int. (By J. W. Powell), pp. 243-302.

Matthew, W. D., 1921. Stehlinius A New Eocene Insectivore: Am. Mus. Novitates, No. 14, pp. 1-5.

Miller, W. E., 1973. A Pleistocene mammal fauna from Salt Lake City, Utah; Geol. Soc. Amer. Abstracts, V. 5, No. 1, p. 81.

Moussa, M. T., 1968. Fossil tracks from the Green River Formation (Eocene) near Soldier Summit, Utah: Jour. Paleon., V. 42, No. 6, pp. 1433-1438.

Osborn, H. F., 1895. Fossil mammals of the Uinta Basin, Expedition of 1894; Amer. Mus. of Nat. Hist. Bull., V. 17, Art. 2, pp. 71-105.

Osborn, H. F., 1909. Cenozoic mammal horizons of Western North America: U. S. Geol. Surv. Bull., V. 361, p. 1-138.

Osborn, H. F., 1929. The Titanotheres of ancient Wyoming, Dakota, and Nebraska: U. S. Geol. Surv. Monograph 55, V. 1-2, pp. 1-953.

Osborn, H. F., and W. B. Scott, 1890., a. The Mammalia of the Uinta Formation: Amer. Philo. Soc. Trans. n.s., V. 16, pp. 461-572.

Osborn, H. F., and W. B. Scott, 1890., b. Preliminary Report on the vertebrate fossils of the Uinta Formation, collected by the Princeton expedition of 1886: Amer. Philo. Soc. Proc., V. 24, pp. 255-264.

Parker, Lee R., 1970. A Titanothere from the Eocene Green River Formation of Utah: Geol. Soc. Amer. Abstr., V. 2, No. 6, p. 400.

Peterson, O. A., 1918. New artiodactyls from the Upper Eocene of the Uinta Basin, Utah [Abstr.]; Geol. Soc. Amer. Bull., V. 29, p. 153.

Peterson, O. A., 1919. Report upon the material discovered in the upper Eocene of the Uinta Basin by Earl Douglass in the years 1908-9 and by O. A. Peterson in 1912; Carnegie Mus. Ann., V. 2, Nos. 2-4, pp. 40-168.

Peterson, O. A., 1934. List of Species and Description of New Material from the Duchesne River Oligocene, Uinta Basin, Utah; Ann. Carnegie Mus., V. 23, pp. 373-389.

Picard, M. D., 1955. Subsurface stratigraphy and lithology of Green River Formation in Uinta Basin, Utah: Am. Assoc. Petr. Geol. Bull., V. 39, pp. 75-102.

Picard, M. S., 1957. Green River and Lower Uinta Formations, subsurface stratigraphic changes in central and eastern Uinta Basin, Utah: in Intermtn. Assoc. Petr. Geol. Guidebook, 8 Ann. Fld. Conf., pp. 116-130.

Picard, M. S., 1959. Green River and Lower Uinta Formation subsurface stratigraphy in Western Uinta Basin, Utah; Intermtn. Assoc. Petr. Geol. Guidebook of the Geology of the Wasatch and Uinta Mtns. transition area. 10 Ann. Fld. Conf. 1959, pp. 139-149.

Picard, M. D., 1968. Sedimentary cycles in the Green River Formation (Eocene) Uinta Basin, Utah; Jour. Sed. Petrol., 38, No. 2, pp. 378-383.

Picard, M. D., W. D. Thompson and C. R. Williamson, 1973. Petrology, geochemistry, and stratigraphy of black shale facies, Uinta Basin, Utah; Utah Geol. and Mineral Surv. Bull. 100, pp. 1-52.

Powell, J. W., 1876. Report on the geology of the eastern portion of the Uinta Mountains and a region of country adjacent thereto: U.S. Geol. and Geog. Surv. of the Terr. (J. W. Powell, Geologist, in charge) pp. 1-218.

Riggs, E. S., 1912. New or little known titanotheres from the lower Uinta formations: Field Mus. Nat. Hist. Pub. 159 (Geol. Surv. V. 4, No. 2) pp. 17-41.

Roberts, D. C., 1962. A Study of Echmatemys Callopyge from the Uinta Eocene of Utah and its redefinition as a subspecies of E. Septaria. Harvard Coll. Mus. Comp. Zoology Bull., V. 127, No. 6.

Robinson, P., 1968. The Paleontology and Geology of the Badwater Creek Area, Central Wyoming; Part 4, Late Eocene Primates from Badwater, Wyoming with a Discussion of Material from Utah; Carnegie Mus. Ann., V. 39, Art. 19, pp. 307-326.

Sanborn, A. F., and J. C. Goodwin, 1965. Green River Formation at Raven Ridge, Uintah County, Utah: Mtn. Geologist V. 2, No. 3, pp. 109-114.

Scott, W. B., 1888. The Upper Eocene lacustrine formations of the United States; Am. Assoc. Adv. Sci. Proc., V. 36, p. 217.

Scott, W. B., 1895. Protoptychus hatcheri, A new rodent from the Uinta Eocene; Acad. Nat. Sci. Phila. Proc., pp. 269-286.

Scott, W. B., 1898. Preliminary note on the Selendont Artiodactyls of the Uinta Formation; Amer. Philos. Soc. Proc., V. 37, No. 157, pp. 1-9.

Scott, W. B., 1899. The Selenodont Artiodactyls of the Uinta Eocene; Wagner Free Press I., Sci. Trans. 6, pp. 1-121.

Scudder, S. H., 1877. The first discovered traces of fossil insects in the American Tertiaries; U. S. Geol. and Geog. Surv. Terr. (Hayden), V. 3, pp. 741-762.

Scudder, S. H., 1890. The Tertiary Insects of North America; U. S. Geol. Surv. of the Terr. (Hayden in charge), V. 13, pp. 1-734.

Scudder, S. H., 1892. Some insects of special interest from Florissant, Colo., and other points in the Tertiaries of Colorado and Utah; U. S. Geol. Surv., V. 93, pp. 1-35.

Stirton, R. A., 1959. Time, Life and Man; John Wiley and Sons, pp. 1-

Stokes, W. L., J. H. Madsen and L. F. Hintze, 1961-1962. Geologic Map of Utah; Dept. Geol., Univ. Utah Publ., 4 pp.

Swain, F. M., 1956. Early Tertiary ostracode zones of Uinta Basin [Colo.-Utah], *in* Intermtn. Assoc. Petrol. Geol., 7 Ann. Fld. Conf., 1956, pp. 125-139.

Swain, F. M., 1964. Tertiary fresh-water ostracodes of the Uinta Basin and related forms from southern Wyoming, western Utah, Idaho, and Nevada; *in* Guidebook to the Geol. and min. resources of the Uinta Basin Utah's hydrocarbon storehouse: 13 Ann. Fld. Conf., Intermtn. Assoc. Petr. Geol., p. 173-180.

Tanner, V. M., 1920. Notes on the collection of fossil fishes contained in the University of Utah collection, with the description of one new species; Univ. Utah Bull., V. 15, No. 6, pp. 1-10.

Thorpe, M. R., 1923. New species of Uinta Carnivora from White River Utah; Am. Jour. Sci. 5 Series, V. 205, p. 218-224.

Untermann, G. E., and B. R. Untermann, 1953. Geology of the Uinta Mountain Area, Utah-Colorado; *in* Soc. Vertebrate Paleontology, Guidebook, 6 Ann. Fld. Conf., 1953, pp. 1-12.

Walton, P. T., 1957. Cretaceous stratigraphy of the Uinta Basin; *in* Intermtn. Assoc. Petr. Geol. Guidebook, 8 Ann. Fld. Conf., 1957, pp. 97-101.

West, R. M., 1971. Late Eocene Apatemyid insectivores; Utah and California [Abst.]; Geol. Soc. Amer. Abstr., V. 3, No. 2, p. 215.

Wheeler, W. H., 1961. Revision of the Uintatheres; Yale Univ. Peabody Mus. Nat. Hist. Bull., 14, pp. 1-93.

White, T. E., 1964. The Dinosaur Quarry; in Guidebook to the Geology and Mineral Resources of the Uinta Basin, Utah's Hydrocarbon Storehouse: 13 Ann. Fld. Conf., Intermtn. Assoc. Petr. Geol., pp. 21-28.

Winchester, D. E., 1916. Oil shale in northwestern Colorado and adjacent areas; U. S. Geol. Surv. Bull., V. 641-F, pp. 139-198.

Winchester, D. E., 1918. Oil shale of the Uinta Basin, northeastern Utah; U. S. Geol. Surv. Bull., V. 691-B, pp. 27-50.

Wood, A. E., 1956. A new genus of paramyid rodent from the upper Eocene [Utah]; Jour. Paleo., V. 30, No. 3, pp. 753-755.

Wortman, J. L., 1898. The extinct camelidae of North America and some associated forms; Amer. Mus. Nat. Hist. Bull., V. 10, Art. 7, pp. 93-142.

Wortman, J. L., 1901. Studies of Eocene Mammalia in the Marsh collection, Peabody Museum: Am. Jour. Sci., V. 4, Nos. 11-17, pp. 333-214.